

Wales: Hillforts of the Iron Age

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The Acropolis

7

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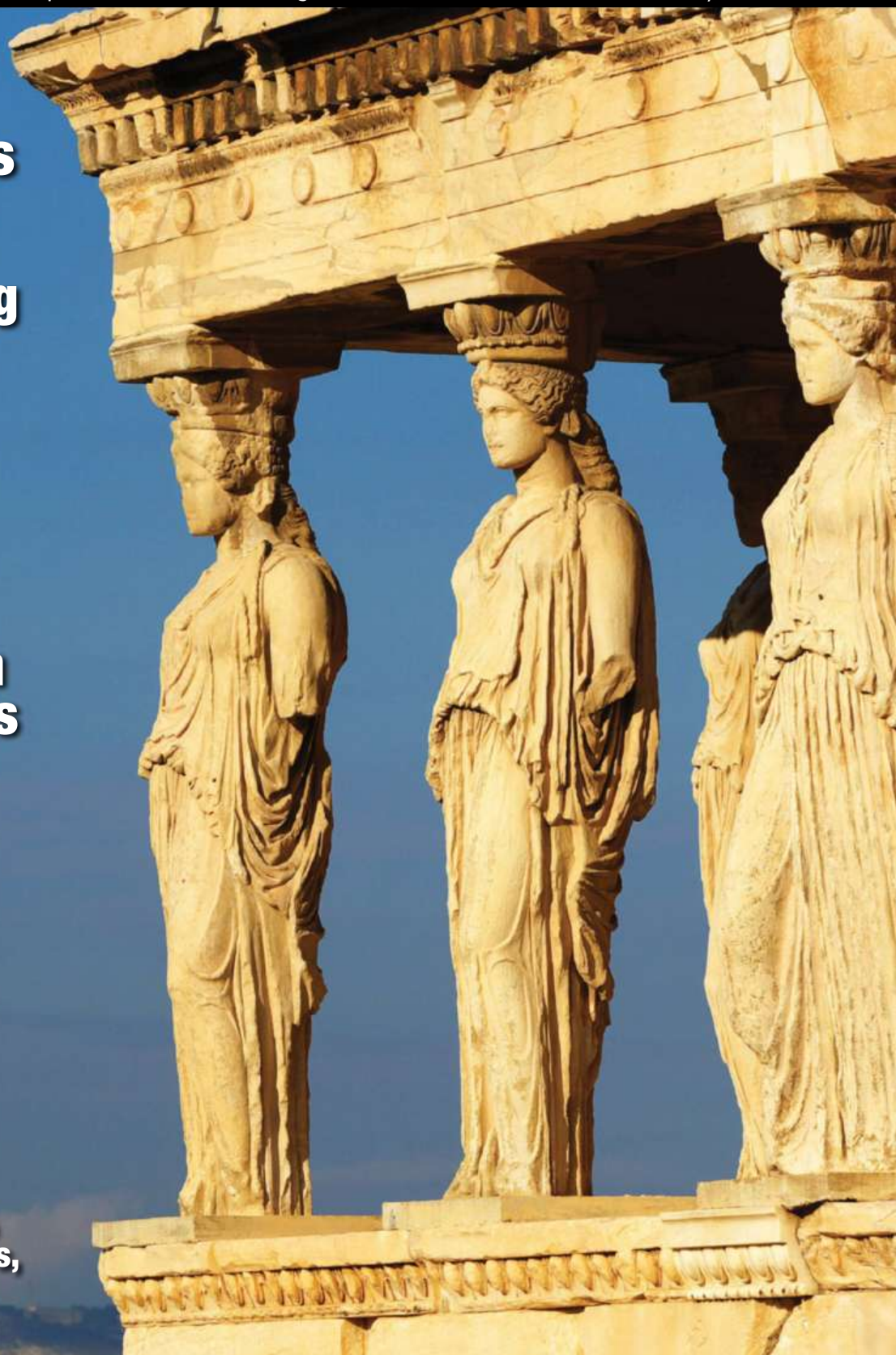
World of the Celts

Secrets of an Arabian Oasis

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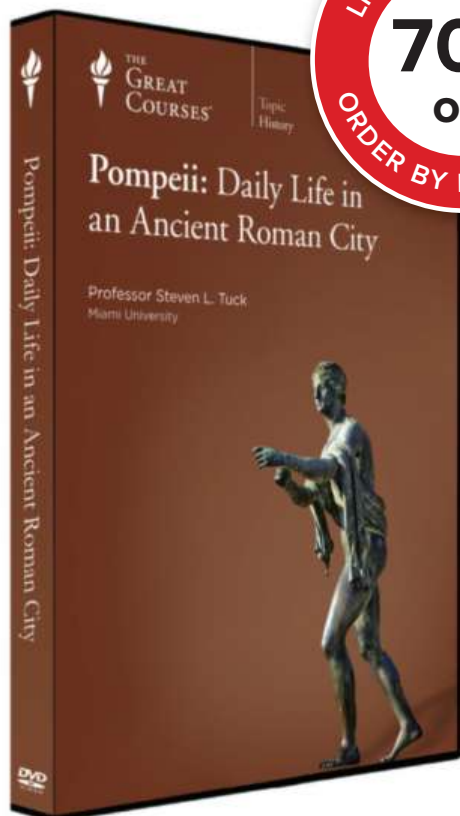
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Location, Location, Location

From the time the Mycenaeans built the first fortification wall atop the rock of the Acropolis in the thirteenth century B.C., the site has been synonymous with Athens and everything that that implies. Inevitably, time, the elements, and human intervention have exacted a devastating toll there. In our special section, "The Acropolis of Athens" (page 28), executive editor Jarrett A. Lobell follows the efforts of the Committee for the Conservation of the Acropolis Monuments and its hundreds of experts and staff who, over four decades, have not only sought to restore the site's most symbolic areas and buildings, but have also set themselves the task of re-creating their original appearance.

The importance of water to the success of any city is a given, and few places provide greater evidence of this than the site of the ancient town of Tayma, located in northwestern Saudi Arabia. An oasis of legend, with mentions of its water in the book of Isaiah, the long story of Tayma, which possibly dates as far back as the third millennium B.C., is varied and impressive. "Where the Wells Never Go Dry" (page 38), by contributing editor Andrew Lawler, traces its history as a cosmopolitan city with a significant role in ancient Middle



Wine vessel, Lavau, France

Eastern trade, including its use, in the sixth century B.C., by Babylon's King Nabonidus during his self-imposed exile. What we learn is that ancient Arabia was surely no wasteland.

In north-central France, at the village of Lavau, archaeologists have discovered one of the richest graves in the Celtic world. "Eternal Banquets of the Early Celts" (page 44), by contributing editor Jason Urbanus, surveys research at a remarkable early-fifth-century B.C. tomb whose contents include an exquisitely crafted bronze cauldron of either Greek or Etruscan origin. The discovery offers significant findings on the power politics of Iron Age Celtic chieftains, the sophisticated trade relations they enjoyed with the Mediterranean, and intriguing evidence about the identity of the person buried there.

One's favorite watering hole doesn't immediately come to mind as having potential as an archaeological site, but "Where There's Smoke..." (page 50), by deputy editor Samir S. Patel, could change your thinking. In this piece, Patel surveys the innovative research project being conducted by archaeologist Anthony Graesch at Connecticut College. By creating data sets out of the remains of discarded cigarette butts outside local bars, Graesch's students are learning not just about the habits of regulars, but also how to really see what an archaeological site might have to offer.

And don't miss "Letter from Wales" (page 54), by online editor Eric A. Powell, offering new insights into the Iron Age hillforts that dot its heather-clad landscapes.

Claudia Valentino

Claudia Valentino
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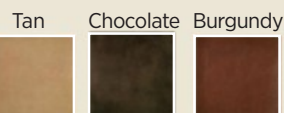
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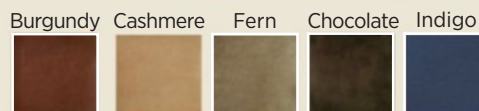
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Dating the Human Past

Advances in the precision of radiometric dating are radically changing our views of the timing of key events in the human timeline. These tighter chronologies are providing insights that were beyond reach a generation ago. This past spring, archaeologists discovered what are now considered the earliest known stone tools at the 3.3-million-year-old site of Lomekwi 3 in Kenya. These tools are 700,000 years older than ones likely made by *Homo habilis*. Researchers suspect that the Lomekwi 3 tools may actually have been made by a more ancient human ancestor, possibly one of the australopithecines.

This year, as well, refinements in radiocarbon dating using accelerator mass spectrometry (AMS) have helped to confirm that, around 40,000 years ago, Neanderthals and modern humans lived side by side in Europe for up to 5,000 years. In this way, AMS is bolstering DNA studies that indicate that the two groups interbred.

Tool from Lomekwi, Kenya



AMS dating is also bringing fresh evidence to the long-standing debate over the precise date of the volcanic eruption on the island of Thera. Researchers have attempted to pinpoint the event, which is agreed to have happened around 1600 B.C., and would have had a significant impact on Minoan civilization. Greater precision in dating is allowing archaeologists to compare or “synchronize” historical and archaeological evidence from regions far distant from Thera, including Turkey and Egypt, to find answers.

In contemporary archaeology researchers are often working with minute samples of bone, or even charred seeds, to answer some of the biggest questions in the field. AMS dating of the earliest domesticated crops and animals in the Middle East, Africa, and the Americas has brought new precision to the vexed question of when agriculture began. In this way, we now know that farming started in the Middle East around 13,000 years ago, and that it took several millennia for people to adopt this new way of life across the region.

Even the impacts of climate change on human affairs are being addressed by way of accurately dating evidence gathered from such diverse sources as ice cores, marine sediments, and other geological phenomena. A sharp onset of aridity around 6200 B.C. spurred the spread of farming from the Middle East to Eurasia and Africa. Similar events around 2000 B.C. and 1200 B.C. disrupted early civilizations across the Middle East.

In ways that past generations of archaeologists could never have imagined, we are able to refine our knowledge not just of what happened, but when it happened. These new insights, some subtle, and some dramatic, will continue to clarify our human past.

Andrew Moore

President, Archaeological Institute of America

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The Meaning of Graffiti

Your article "Writing on the Church Wall" (September/October 2015) was fascinating. The illustration of circular floral designs revealed motifs familiar to students of sacred geometry. Although I fully realize we don't often give enough credit to our ancestors, despite millennia of incredible creations, the ability of many different individuals to draw, much less scratch or etch, such perfectly symmetrical and intricate images, seems unlikely to be "graffiti."

Richard E. Behymer
Sonora, CA

The editors respond: "Graffiti," particularly as used in archaeology, does not have a negative connotation. It is simply a term used to classify inscriptions or drawings made on public surfaces, such as a rock or a wall.

ARCHAEOLOGY welcomes mail from readers. Please address your comments to ARCHAEOLOGY, 36-36 33rd Street, Long Island City, NY 11106, fax 718-472-3051, or e-mail letters@archaeology.org. The editors reserve the right to edit submitted material. Volume precludes our acknowledging individual letters.

Print Matters

I was quite interested in "New York's Original Seaport" (September/October 2015). I was also very surprised by the caption that mentions George Schlegel's printing shop at 97 William Street. Being extremely interested in the history of New York State, I have some information to add. In 1946 my father, Charlie Leidig, after leaving the U.S. Navy, became an apprentice at another lithographic print shop at 200 William Street, named Snyder & Black. He worked his way to plant foreman. George Arata was president and a George Kamps was something of a foreman until they moved in 1957 or 1958. Snyder & Black moved to 415 Knollwood Road in White Plains, New York, and became Snyder & Black & Schlegel. At the young age of 11 or 12, I met all three Georges.

George Schlegel was a very nice man, perhaps in his early 70s. By approximately 1959 Snyder & Black & Schlegel merged once more, adding Seagrams, and this lithographic plant, if it wasn't the largest in the nation, was probably the largest east of the Mississippi River. There were 12 72-inch Miele printing presses running down this long pressroom with, if I remember correctly, spots for four more. Most all of the big jobs were printed there at one time or another, especially in the late 1950s. Among [the clients] were General Motors, Chrysler, General Foods, Kraft, Coca-Cola (especially all their classic Christmas advertising), Alcoa Aluminum, many of the airlines, and Continental Can. [They also printed] many cigar wrappers for the bigger companies, not just four-color, but also

in six and seven colors, including silver and gold. When the pressmen were printing the silver, they all had to drink a certain amount of milk during the day, as the silver ink depleted calcium, which had to be constantly replaced in their bones.

I truly thank Jason Urbanus for such an extremely interesting article, which I am keeping!

Don Leidig
Otego, NY

Corn Palace

In "Golden House of an Emperor" (September/October 2015), Suetonius is quoted as saying in *The Lives of the Caesars*, "...and besides that, various rural tracts of land with vineyards, cornfields, pastures..." I was taught that corn was not introduced into the Old World until some 1,400 years later. Could you please clarify this?

Gary Quillia
Freeport, NY

The editors respond: The word "corn" is often misunderstood as only pertaining to the American agricultural product known as maize, when in actuality it can be used to apply to any cereal crop that is dominant in a particular region, whether that be wheat, barley, oats, millet, or maize. Roman corn was usually wheat or barely, but we often use the general term "corn" in translation when the specific type of cereal grain is uncertain.

Correction

The skeleton on page 49 of the September/October 2015 issue was incorrectly identified; it belongs to an adolescent child of unknown gender.



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From the Trenches

LATE-BREAKING NEWS AND NOTES FROM THE WORLD OF ARCHAEOLOGY

The Second Americans?

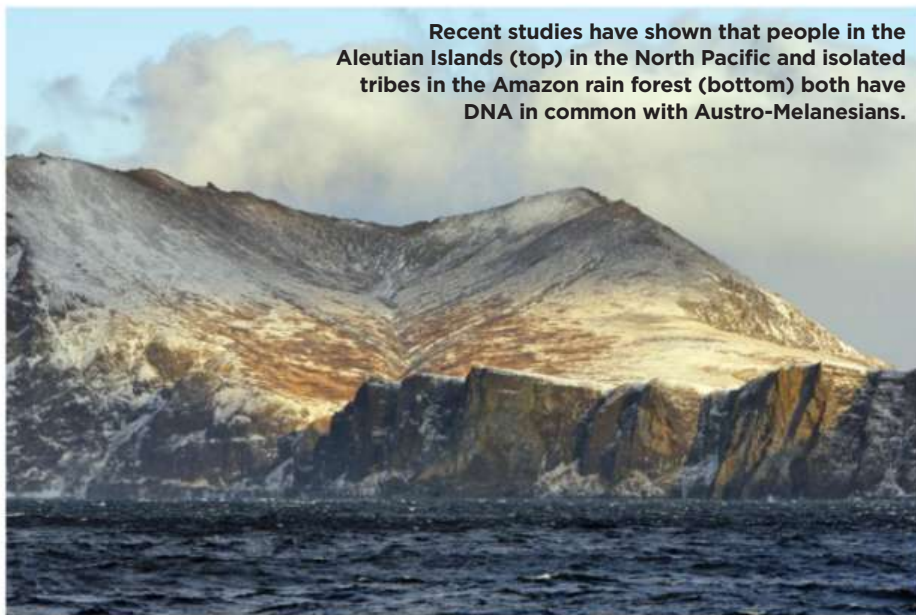
Just when the story of the peopling of the Americas starts to clear up, it becomes a little more complex again.

In June 2015, after nearly two decades of debate, a genetic analysis of Kennewick Man—an ancient American discovered in Washington State in 1996 and dating back roughly 8,500 years—found him to be most closely related to modern Native Americans, despite his cranial features suggesting Polynesian ancestry. The finding bolstered the hypothesis that a single founding population, of East Asian (with some Siberian) ancestry, originally settled the Americas. These people became isolated for a time in Beringia in the northern Pacific, and then began populating the Western Hemisphere a little more than 15,000 years ago.

But not so fast. This summer two separate research groups reported finding faint genetic signals common to indigenous Australians and Melanesians among widely separated populations in the Americas, suggesting a second influx of people. The researchers disagree on the timing of that migration.

The lab of Harvard geneticist David Reich found a genetic connection between isolated tribes in Brazil's Amazon rain forest and indigenous people of Australia, New Guinea, and the Andaman Islands, in the Bay of Bengal. They attribute the presence of this DNA—roughly 2 percent of Amazonian ancestry—to a second founding population that arrived in the Americas not long after the Asian ancestors of modern Native Americans. “My gut feeling about this is that it goes back to the Pleistocene—I think it's at least 12,000 years ago that it came to the

Recent studies have shown that people in the Aleutian Islands (top) in the North Pacific and isolated tribes in the Amazon rain forest (bottom) both have DNA in common with Austro-Melanesians.



Americas,” says Pontus Skoglund, a postdoctoral researcher in Reich's lab, about the second “pulse” of settlers.

The other research group, led by Eske Willerslev at the University of Copenhagen (who also oversaw the project

clearing up the Kennewick Man mystery), disagrees. They found that people in the Aleutian Islands of the Bering Sea also show some genetic legacy from the Austro-Melanesians. Because scientists believe the Aleutians were first reached only about 9,000 years ago, they see this theorized second population coming much later than the first arrivals to the Americas—and thus not qualifying as a “founding” population. They believe this smaller, subsequent arrival flowed through the Aleutians before possibly taking a coastal route to South America.

Archaeologist Tom Dillehay of Vanderbilt University, who was not involved in either research effort and who was pivotal in pushing back the

date of entry for the first Americans to around 15,000 years ago, cautions that the process of the peopling of the Americas was more complex than we can imagine, and that new genetic findings like these need to be taken in this larger context. “Here we go again,” he says. “Is it going to be one migration or two migrations?”

Michael Collins, an archaeologist from Texas State University, echoes this sentiment. He notes that the theories being posited are based on relatively small samples of genetic data to represent all of the Western Hemisphere. “At this stage, there’s been so much intermixing, I can’t believe they want to go so far out on that limb,” he adds.

Rasmus Nielsen, an evolutionary

geneticist at the University of California, Berkeley, who worked on the University of Copenhagen study, says the key to settling this or any debate on the peopling of the Americas to find and analyze more skeletal evidence from the period. Both research efforts rely on just a few samples older than 4,000 years. “We really want to get more from Brazil, but of course preservation is not great in a tropical environment,” he says. “I am personally not fully happy with any of the explanations.”

Time and additional research will likely make the story of the first Americans even more complex and—eventually, hopefully, paradoxically—clearer at the same time.

—NIKHIL SWAMINATHAN

OFF THE GRID

In 1940, newly installed British Prime Minister Winston Churchill ordered the construction of gun batteries and tunnels in the chalk of the White Cliffs of Dover, just 21 miles from Nazi-occupied France, to prevent German ships from moving freely through the English Channel. The Fan Bay Deep Shelter, a series of tunnels to protect the gun battery teams from bombardment, was completed in just 100 days and could house up to 185 soldiers.

The tunnels were taken out of commission in the 1950s and filled with rubble in the 1970s. The National Trust purchased the land in 2012, and the next year the shelter was rediscovered. The volunteer staff of the Fan Bay Project, alongside archaeologists, mine consultants, engineers, and geologists, moved 100 tons of debris by hand

over 18 months, revealing the tunnels’ infrastructure and a wealth of graffiti from the time. Jon Barker of the National Trust and Keith Parfitt of the Canterbury Archaeological Trust say that the tunnels are time capsules of emotion and provide great insight into wartime life.

The site

The Fan Bay installation consisted of a gun battery, searchlights, a generator house, barracks, magazines, and a plotting room, all situated above the Deep Shelter—five bomb-proof tunnels and a hospital totaling 3,500 square feet, sitting 75 feet below the top of the cliffs. The clearing of the tunnels has made them accessible to the general public for the first time. Reinforced with girders and metal sheeting, they preserve an abundance of wartime graffiti, including soldiers’ names and service numbers. Near a toilet are rhymes about one challenge of wartime: the lack of toilet paper. “If you come into this hall use the paper not this wall,” one reads. “If no paper can be found then run your arse along the ground.” Guides lead visitors—with hard hats and flashlights—down 125 steps to the tunnels, as

well as to two World War I sound mirrors, large concave concrete discs that were among the first early warning air defense devices in Britain.



Fan Bay gun battery, World War II

While you’re there

The White Cliffs of Dover live up to their name, and a variety of viewpoints offer sweeping vistas—Stay away from the cliff edge!—of the chalk facade, the channel, and, on a clear day, France. An engineering marvel of the Victorian period, the South Foreland Lighthouse just outside Dover was the first in the world to use electric light, and still serves traditional tea in the lighthouse-keeper’s cottage. In addition, there are Roman lighthouses in Dover, overlooking the site of Portus Dubris, a second-century port, which includes the Roman Painted House, a *mansio*, or government hostel, decorated with more than 400 square feet of murals related to Bacchus, the god of wine.

—MALIN GRUNBERG BANYASZ

Fan Bay Deep Shelter, Dover, England



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How Much Water Reached Rome?



Anio Novus aqueduct, Italy

Rome's 11 aqueducts, some extending for more than 50 miles, transported enough water to feed the city's 591 public fountains, as well as countless private residences. However, experts have long been divided about how much water each aqueduct could actually convey. "Many assumptions have been

made based on some pretty unreliable ancient data concerning the size of the flows of Rome's aqueducts, giving some very inflated figures," says archaeologist Duncan Keenan-Jones of the University of Glasgow. "We thought it was important to adopt a more scientific approach."

Keenan-Jones is part of a team of

scientists who measured the amount of residual mineral deposits in the Anio Novus aqueduct to accurately gauge the depth and flow rate of water. By analyzing travertine—a type of limestone deposit—that was left on the aqueduct's interior walls and floor, the researchers calculated a flow rate of 1.4 cubic meters per second, or between 100,000 and 150,000 cubic meters (25 to 40 million gallons) per day, a number below traditional estimates. The amount of water actually reaching the city was hindered by the buildup of travertine on the aqueduct's interior, which considerably lessened the flow. "Our work has shown that often, even shortly after the aqueducts were built, the flow rates were well below the capacity estimates," says Keenan-Jones. "Ancient Rome had a lot of water, but not nearly as much as has often been claimed."

—JASON URBANUS

Paleo-Dentistry

A team led by Stefano Benazzi of the University of Bologna has discovered the earliest known evidence of dental work in a 14,000-year-old molar from a male skeleton found in northern Italy in 1988. Examination of the tooth with a scanning electron microscope revealed striations consistent with scratching and chipping with a sharp stone tool, apparently to



Ancient dental cavity

remove decayed material. Enamel in the area of the cavity is worn away, suggesting the treatment occurred long before death. Benazzi believes that the likely very painful practice of removing tooth decay probably evolved from the use of wooden and bone toothpicks, many of which have been found at Paleolithic sites.

—DANIEL WEISS

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Greyfriars excavation, Oxford, England



Wooden bowl



Drinking cup



Leather shoes

Friars' Leather Shop

An excavation in Oxford, England, conducted by Oxford Archaeology in advance of the expansion of a shopping center, has turned up a large number of leather and wood objects dating to the fourteenth century, when the site was occupied by buildings associated with the Greyfriars religious order. The artifacts were unusually well preserved

because they were buried beneath the water table. Among the finds are around 100 leather shoes, a leather bag, a leather money purse, and a wooden bowl. "Somebody seems to have been saving up worn-out shoes," says Ben Ford, the excavation's project manager. "Maybe it was a cobbler working at the friary."

—DANIEL WEISS

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The Gates of Gath

In the tenth and ninth centuries B.C., and probably even earlier, Gath was likely the largest city in Philistia, a pentapolis—five-city confederation—in the southern Levant. A team of archaeologists led by Aren Maeir of Bar-Ilan University has just uncovered one source of Gath's strength—the monumental stone gate and a section of the wall that served as both entrance to and protection for the city. As home to the Philistines, including, according to the

Old Testament, the giant warrior Goliath, Gath was the strongest and most dominant city in the region for nearly two centuries. Along with Ashkelon, Ashdod, Ekron, and Gaza, it was also a formidable foe of the early Judahite kingdom (also called the “United Kingdom” of David and Solomon) and, says Maeir, “played a central role in the geopolitical scene during these periods.”

—JARRETT A. LOBELL

Gath excavation, Israel



Slinky Nordic Treasures

Archaeologists have excavated a cluster of unusual gold spirals at a site in the Zealand region of eastern Denmark. Researchers from the Danish National Museum found 2,000 of the delicate, spring-like artifacts in a pair of concentrated deposits, preserved under layers of plowed soil.

Flemming Kaul of the Danish National Museum says that it is not clear what the spirals meant or were used for, but that their purpose was probably ritualistic. Approximately

Gold spirals



300 of them were found close to pitch fragments that suggest they had been placed in a wooden votive container.

They date to the Nordic Late Bronze Age, between 900 and 700 B.C., when the local culture worshipped a sun god, according to Kaul.

In the nineteenth century, carved gold vessels were found at the site, and two years ago amateurs found gold bracelets nearby. The finds suggest that the region was a center of wealth. “We regard this area, the gold-richest area of Scandinavia,” Kaul says, “as a center for rituals and for religion.”

—JACK MARTINEZ

Lake George's Unfinished Fort

Archaeologists working near upstate New York's Lake George have uncovered ruins from a partially constructed British fort that was once planned to be their largest in North America. Due to its key location along the waterways connecting New York and Canada, Lake George played a crucial role in the eighteenth-century French and Indian War and, later, the Revolutionary War. The lake and its forts, including Ticonderoga and William Henry, were the sites of pivotal clashes between French and British troops, described famously in James Fenimore Cooper's *The Last of the Mohicans*. In 1759, British general Jeffrey Amherst ordered the construction of a massive new fort, Fort George, on a rise overlooking the lake's southern shore. However, after Amherst's troops captured the French Fort Carillon (renamed Ticonderoga) later that year, work on Fort George ceased, with only one large corner bastion having been completed. Even so, both British and American soldiers used the site for more than two decades.

The current archaeological investigation, directed by David Starbuck of Plymouth State University and researchers from SUNY Adirondack, is searching beyond the old fort's known ruins, now part of a public park. "Although the scenic ruins of Fort George are an annual attraction for hundreds of thousands of summer visitors, until recently there was no awareness of what else might have survived," says Starbuck. The team discovered sections of a stone wall, measuring at least six feet high and five feet thick,

along with the remains of underground casement rooms used for the storage of supplies and munitions. Artifacts such as tin-glazed earthenware pottery, buttons, butchered bones, and musket balls are helping to reveal what life was like for the provincial colonial-era soldier. The fort's masonry also betrays the change in British mentality regarding fortifications

in the area. "Most of these frontier forts were ephemeral and built to last only a season or two," says Starbuck. "Only the ruins of Fort George reveal that a British garrison had built more permanent walls, perhaps hoping that they might better survive the next artillery bombardment from French attackers."

—JASON URBANUS



Fort George excavation, New York

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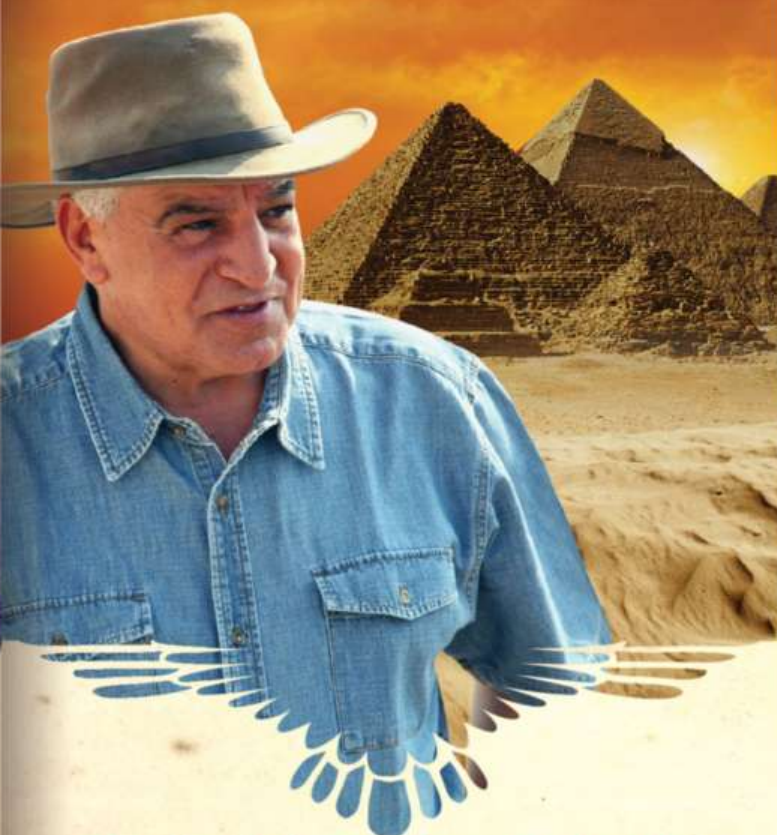

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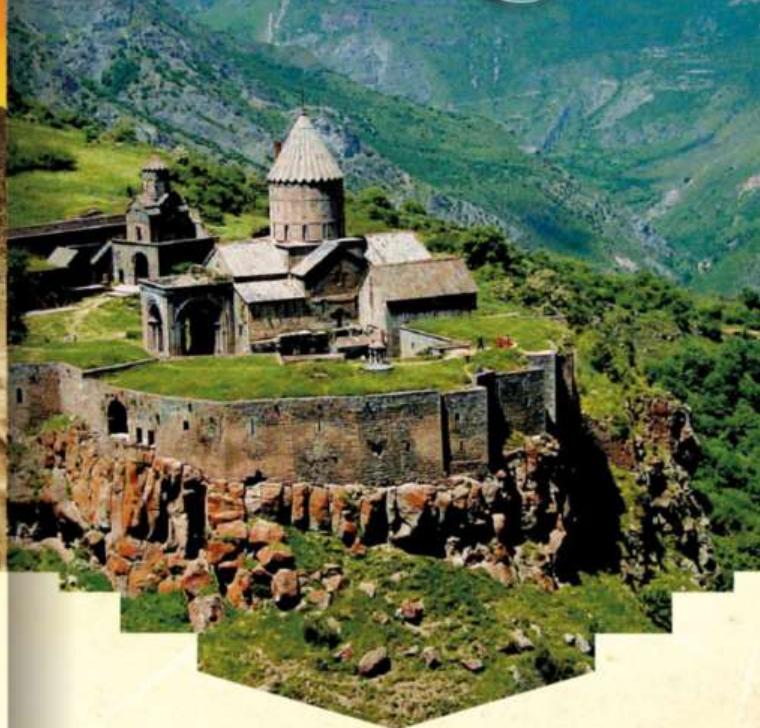
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Last Flight of a Tuskegee Airman

Instrument panel



The wreckage of a Bell P-39 Airacobra in Lake Huron—last flown on a 1944 training mission by 2nd Lt. Frank Moody—was examined recently by a team led by Wayne Lusardi, Michigan's state maritime archaeologist. Moody, who died in the crash, was one of the famed Tuskegee Airmen, the U.S. military's first group of African-American aviators. This is the first archaeological documentation of the wreckage, which was found last year. Lusardi's team included divers from the Thunder Bay National Marine Sanctuary and Diving with a Purpose (DWP), a nonprofit dedicated to maritime history and archaeology involving African Americans. Five DWP members came from across the country to help with the project, and held a brief service for Moody aboard the dive boat. For more about the underwater archaeology of Lake Huron, see "Shipwreck Alley" (January/February 2015).

—SAMIR S. PATEL

Bell P-39 Airacobra



Starboard landing gear



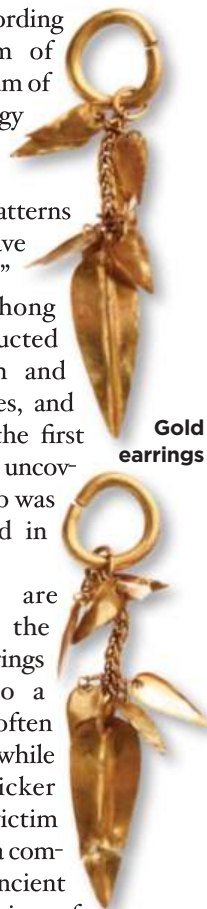
Port running light

Mysterious Golden Sacrifice

Archaeologists excavating the Geumgwanchong (“Gold Crown”) tomb in Gyeongju in the Korean province of North Gyeongsang have discovered an extremely rare pair of gold earrings dating to the Silla Dynasty (57 B.C. to A.D. 935). “Although Koreans have found hundreds of Silla-era gold earrings in tombs that belonged to noblemen and noblewomen,” according to Dae-hwan Kim of the National Museum of Korea’s archaeology and history department, “the composition, forms, and patterns on these earrings have never been seen.” The Geumgwanchong tomb was constructed between the fifth and early sixth centuries, and is the site where the first Silla gold crown was uncovered when the tomb was originally excavated in 1921.

Archaeologists are also intrigued by the fact that the earrings likely belonged to a male—Silla men often wore thin earrings, while women wore thicker ones—who was a victim of human sacrifice, a common custom in ancient Korea. The identity of the Geumgwanchong tomb’s owner remains one of the most enduring mysteries in Korean archaeology. Researchers have found items, including a sword with engraved letters reading “King Yisaji,” but there is no mention of him in existing Silla records.

—HYUNG-EUN KIM





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Aftermath of War

Among the many things that seemingly disappeared during the chaotic end of World War II were 217 gold coins recently rediscovered by a metal detectorist who alerted archaeologists to the find. The coins date to between 1831 and 1910 and had been placed in two sacks closed with official bank seals, and then hidden at least three

feet underground. Archaeologist Edgar Ring of the Lüneburg Museum thinks they may have been stolen from the local branch of the Deutsche Reichsbank, the Nazi-era central bank. “So far we can only speculate how the sacks came to the site and why they weren’t picked up,” says Ring.

—JARRETT A. LOBELL

German gold coins



Lüneburg excavation, Germany

Game of Diplomacy

In the thirteenth century A.D., people living in a cave near Utah’s Great Salt Lake spent their free time playing games. Excavations there, led by University of Alberta archaeologist John Ives, have unearthed some 1,300 gaming and gambling pieces, including dice made from split cane. Ives believes the avid gamers were Apache and Navajo ancestors who spent one or two generations in the cave during a long migration to the American Southwest from subarctic Canada. It was a turbulent time, with environmental and social changes roiling the continent, and games may have been helpful in dealing with unfamiliar and potentially hostile neighbors. “Playing games can be a way of negotiating new relationships,” says Ives, “particularly between people who may not have spoken the same language.”

—ERIC A. POWELL

Split cane dice

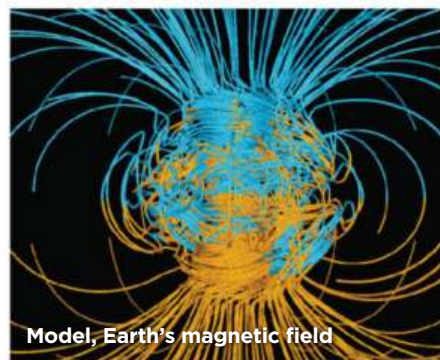


The Magnetism of the Iron Age

The Earth's magnetic field helps protect the planet's surface from the solar wind and cosmic rays. It's not a static barrier, but rather a complex system generated by iron flowing in the Earth's outer core. Every few hundred thousand years, the north and south magnetic poles "flip" position, and for the last 160 years, the magnetic field has been weakening. The causes of the reversals and weakening are unknown, but scientists are finding clues in the charred remains of Iron Age houses in southern Africa.

During the Iron Age, people there would, perhaps because of a bad harvest, ritually "cleanse" their villages by burning them down. The fires burned hot enough to melt magnetic materials in the clay. When those materials cooled and solidified, they were remagnetized by the magnetic field, recording its intensity and direction at that moment.

Southern Africa lies within the South Atlantic Anomaly, a particularly weak patch in the magnetic field, larger than the United States. If it grows large enough, according to University of Rochester geophysicist John Tarduno, it could trigger a reversal of the poles. Understanding



Model, Earth's magnetic field

how the magnetic field, especially in southern Africa, has changed over time might help scientists better comprehend these processes, since there has not been much good historical data on the southern magnetic field. Because of Iron Age superstition, Tarduno and his colleagues now have a record of the anomaly for

between 1,600 and 1,000 years ago.

The findings show that during the Iron Age, the magnetic field was as it is today: weakening, with a big southern dent. The field has recovered to a degree since then, but is now weakening again. This suggests that there is some recurring disruption in the flow of the outer core that, like an eddy in a stream, comes and goes. If that

eddy grows large enough, Tarduno says, a reversal might be imminent. Such a reversal could take thousands of years to be completed, and while the Earth would have some magnetic protection during this time, satellite communications, the ozone layer, and our power infrastructure would all be at some risk.

—SAMIR S. PATEL



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Rituals of Maya Kingship



La Corona excavation, Guatemala



Hieroglyphic panel



Dancing king panel

Two hieroglyphic panels found at the ancient Maya city of La Corona in Guatemala are providing new details about the history of the site's rulers. One panel shows a dancing king from the city of Calakmul, who ruled in the late ninth century A.D. and probably served as overlord of La Corona. A second panel of hieroglyphic writ-

ing tells the story of a king of La Corona named "Red Turkey," the permissions he had to receive, and the rituals he had to perform to earn his crown. Project director Marcello Canuto of Tulane University says, "It's a luxury of detail regarding the accession to the throne."

—ZACH ZORICH

Premature Aging

The use of radiocarbon dating, which allows archaeologists to estimate the age of human, plant, and animal remains, may soon be complicated by fossil fuel emissions. The technique works because carbon, a key component of living things, exists in radioactive and non-radioactive forms. Radioactive carbon decays at a known rate, so researchers can estimate a specimen's age based on the portion of its carbon that is still radioactive.

Fossil fuels are millions of years old and contain no radioactive carbon, so the more of them burn, the lower the proportion of radioactive carbon in the atmosphere and, in turn, in contemporary organic materials. Nuclear weapons testing increased

the amount of radioactive carbon in circulation, but fossil fuel emissions have almost completely countered this effect.

Heather Graven, a climate physicist at Imperial College London, has modeled the potential impact. "In the business-as-usual scenario where fossil fuel emissions are increasing strongly over the century," she says, "by 2050, the atmosphere could have the same radiocarbon date as a sample

that's about a thousand years old." In other words, to future archaeologists, a brand-new garment made in 2050 would have the same proportion of radioactive carbon—and therefore the same radiocarbon date—as one worn by a combatant in the Battle of Hastings, in 1066.

—DANIEL WEISS



Coal power plant, Michigan

Switzerland Everlasting

While neutrality has long been a hallmark of Swiss identity, that wasn't always the case. In 1315, Duke Leopold of Hapsburg set out to consolidate his power within the Holy Roman Empire and marched into areas controlled by the Swiss Confederacy—then a local alliance. According to historical sources, the more experienced, better-equipped Hapsburg knights were ambushed by Swiss soldiers on the shores of Lake Aegeri. “At Morgarten, as the location is called, the foreign forces were stopped and, as the lore goes, badly decimated,” says Stefan Hochuli, an archaeologist with the Swiss Department of the Interior. Hochuli and officials from the cantons of Zug and Schwyz have found evidence, including knives, arrows, and a spur, that may pinpoint the location of the Battle of Morgarten. The decisive, brutal victory is considered a foundational moment for Switzerland, as it strengthened the Everlasting League, the nucleus of the confederacy.



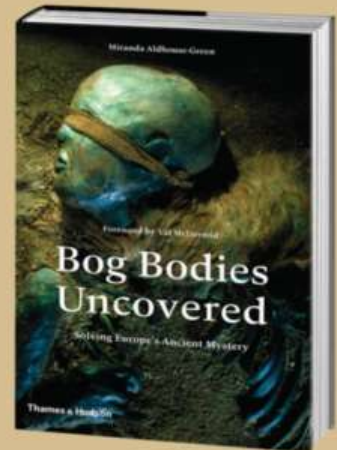
Lake Aegeri, Switzerland

—SAMIR S. PATEL

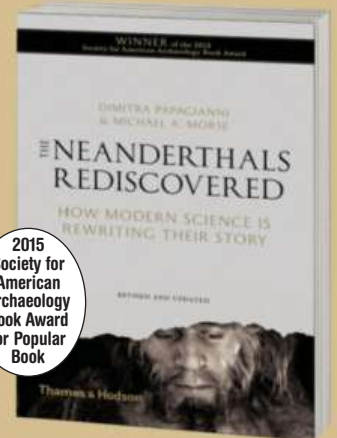


Metal artifacts,
Morgarten excavation

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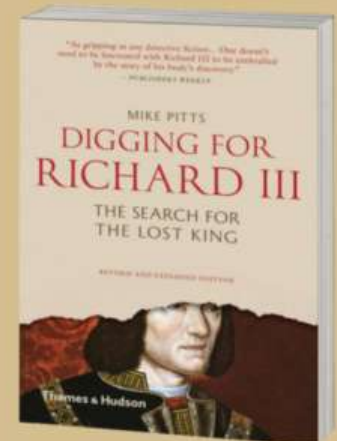


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ALASKA: A crew of 75 manned the doomed last voyage of *Neva*, a ship sailing from the Siberian port of Okhotsk to Sitka in the fall and winter of 1812-1813. Of those, 26 survived a perilous voyage, a violent wreck, and a harrowing, frigid month on shore awaiting rescue.

A multinational team has been excavating the survivor camp and has found artifacts from the wreck, such as sheet copper, metal spikes, and gunflints, that the crew repurposed in their struggle to survive an unfamiliar and dangerous wilderness.

NORTH CAROLINA: Researchers on the oceanographic vessel *Atlantis* were using an automated underwater vehicle to scan for a mooring they had lost in a previous research season. They saw a line and dark patch on the sonar, and sent the submersible *Alvin* to investigate. They didn't find their mooring a mile



down, but rather an unknown shipwreck, with artifacts including bricks, bottles, a sextant (or possibly octant), and pottery that may date it to the time of the American Revolution.



ARIZONA: Throughout the Southwest, archaeologists have found small fiber bundles, called quids, that were chewed by

prehistoric Native Americans, but it is not known why they were chewed. Researchers have examined a collection of quids excavated from Antelope Cave in the 1950s. Ninety percent of those studied, used by Ancestral Puebloan people more than 1,000 years ago, contained bits of wild tobacco. Because they were found among household trash, it is mostly likely these quids were chewed for pleasure rather than some ritual purpose.



PERU: Among the hundreds of sets of human remains excavated from a historic cemetery in Eten, as part of an ongoing regional project, were the remains of a teenage girl whose skeleton had dozens of extra teeth and bone fragments in her abdomen. Close examination revealed that, rather than a sacrificed animal or unborn fetus, the mass was an ovarian teratoma, or a cyst composed of different kinds of tissue, such as hair, bone, and teeth. It is thought to be only the third known ancient example of such a condition.

SOUTH AFRICA: Sidubu and Blombos are two landmark Middle Stone Age sites separated by more than 600 miles. A new, detailed analysis of certain stone tools from both sites reveals that the people at each used the same types of tools around 71,000 years ago, but that there are differences in how they were made. By a few thousand years later, little difference is seen in tool manufacture, suggesting that these groups shared a common tool technology, and then drifted apart and developed their own traditions, before returning to the same methods, perhaps due to increased cultural contact.





SWEDEN: The naturally mummified body of Bishop Peder Winstrup, interred in

Lund Cathedral, is one of the best-preserved sets of 17th-century remains on the continent. A new study of Winstrup, including CT scans, reveals that he had tuberculosis, pneumonia, atherosclerosis, osteoarthritis, gallstones (from a fatty diet), and cavities (from a sweet diet)—and that he had been, predictably, bedridden for some time before death. Investigators also found, quite unexpectedly and as-yet-unexplained, the remains of a 4- or 5-month-old fetus hidden under his feet.



KAZAKHSTAN: Following tips from local officials, archaeologists working at the Koitas cemetery recently excavated a *kurgan*, or burial mound, which had clearly been looted in antiquity. They found scattered bones from an elite Scythian burial, including a vertebra with an entire 2.2-inch-long bronze arrowhead embedded in it. Bone growth suggests that—defying the odds for a spinal injury victim in the Iron Age, or any age, for that matter—the Scythian survived for some time after the blow.



CHINA: For 500 years, residents near the Quinling Mountains in Shaanxi Province

went to Dayu Cave to collect water and—when times were tough—pray for rain. They also left inscriptions about those times that, combined with the isotopic and elemental content of the cave's rock formations, provide a unique historic and geological record of climate and rainfall. Seven separate drought events are recorded in both the inscriptions and deposits, some associated with major social instability. A scientific model suggests that the region is due for severe drought again soon.



NEW ZEALAND: On private Great Mercury Island off the northeast coast, archaeologists are excavating an early Maori site—dating to the second half of the 14th century, perhaps

just decades after Polynesian seafarers first arrived. It appears to be a small fishing settlement, marked by thousands of stone artifacts, as well as fishhooks made from sea mammal teeth and the bones of moa, the large native birds that were hunted to extinction 100 years after human arrival. A number of oceanside sites such as this one are at risk from coastal erosion.



ISRAEL: The Hellenistic site of Maresha, occupied between the 4th and 2nd centuries B.C., might be where chickens became *chicken*. Jungle fowl had been domesticated millennia earlier in Asia and had already spread across Europe, but in small numbers, usually as fighting cocks or for ritual purposes. But at Maresha there are thousands of chicken bones, which tells researchers that the site is key to understanding how the birds came to be regarded as food and bred in large numbers a hundred years before the chicken-chomping craze swept across Europe.

IT'S MUCH EASIER TO BUILD a new building," says Vassiliki Eleftheriou, "than to rebuild an ancient one." Eleftheriou, an architect by training, is director of the Acropolis Restoration Service, where she oversees what could be considered the most daunting project in the history of archaeological conservation.

For thousands of years the monuments of the Athenian Acropolis have been regarded not only as examples of extraordinary skill and beauty, but also as potent symbols of religious devotion and civic and national identity. "Although there were many important sanctuaries and public spaces in Athens and across Attica," says classical art historian Jeffrey Hurwit of the University of Oregon, "the Acropolis stands as what might be called the central repository of Athenians' conceptions of themselves. These monuments and sculptures presented images of the gods and goddesses—Athena herself above all—and also of the Athenians and their heroes." The intention, says Hurwit, was to represent Athens as the greatest of Greek cities and the Athenians as the greatest of Greeks. "To walk through the classical Acropolis was to traverse a marble paean to Athens itself," he says.

The Acropolis rises nearly 500 feet above the Ilissos Valley, measures about 360 feet north to south and 820 feet east to west, and has a surface area of about seven and a half acres.

The site was leveled with artificial fill, in places as much as 55 feet thick, to create a surface upon which to build. Atop it sit the four major standing structures dating to the city's massive building program of the fifth century B.C., initiated after the destruction of earlier monuments in 480 B.C. by the Persians: the Propylaia, Temple of Athena Nike, Erechtheion, and Parthenon. Over the millennia the deterioration of these monuments as a result of the passage of time, and the damage to them from myriad other causes including wars, improper or overly intrusive excavations, new construction, earthquakes, previous restoration efforts, the vast number of visitors to the site, and, most recently, the ravages of pollution and acid rain, have been almost incalculable. In 1975, the Greek government began a large-scale, multidisciplinary project to address the declining condition of these structures, as well as of a lesser-known building called the Arrephorion, the defensive walls encircling the Acropolis, and the so-called "scattered members," the thousands of complete, nearly complete, and fragmentary pieces of stone and marble that lie all over the surface of the Acropolis.

What began as a project to rescue the monuments from further decay and instability has evolved into a comprehensive effort not only to restore them, but also to re-create their original appearance insofar as possible. When faced with this excep-

The Acropolis



The Athenian Acropolis and the spectacular ancient monuments atop it sit high above the modern city.

tional task, the Committee for the Conservation of the Acropolis Monuments followed a governing principle that is applied to all their work. Since the project's inception, teams working on the Acropolis have employed anastylosis, an intervention technique dating to the beginning of the nineteenth century whereby a structure is rebuilt using original materials. New materials are employed only when necessary, must be easily distinguishable from the old, and must be replaceable should better materials or technologies be found. According to Eleftheriou, this has always been one of the greatest challenges. "It's important to use as much ancient material as we can, but there is a limit to how much we can actually use," she says. This is especially true when the team confronts previous efforts at anastylosis. "When we work on sections that have been restored before, it's difficult not to use new materials because previous restorers often put ancient materials in the wrong places and damaged them. So we try to use compatible materials in a compatible way," she explains.

The most ubiquitous and catastrophic of these previous efforts were those of the engineer Nikolaos Balanos, who, between 1898 and 1940, supervised an early attempt to restore the Acropolis. Although the techniques he employed, primarily the use of Portland cement mortar, steel reinforcements, and iron clamps, were generally accepted at the time, after only

a short while, the materials started to deteriorate and rust, damaging and often cracking the ancient stone.

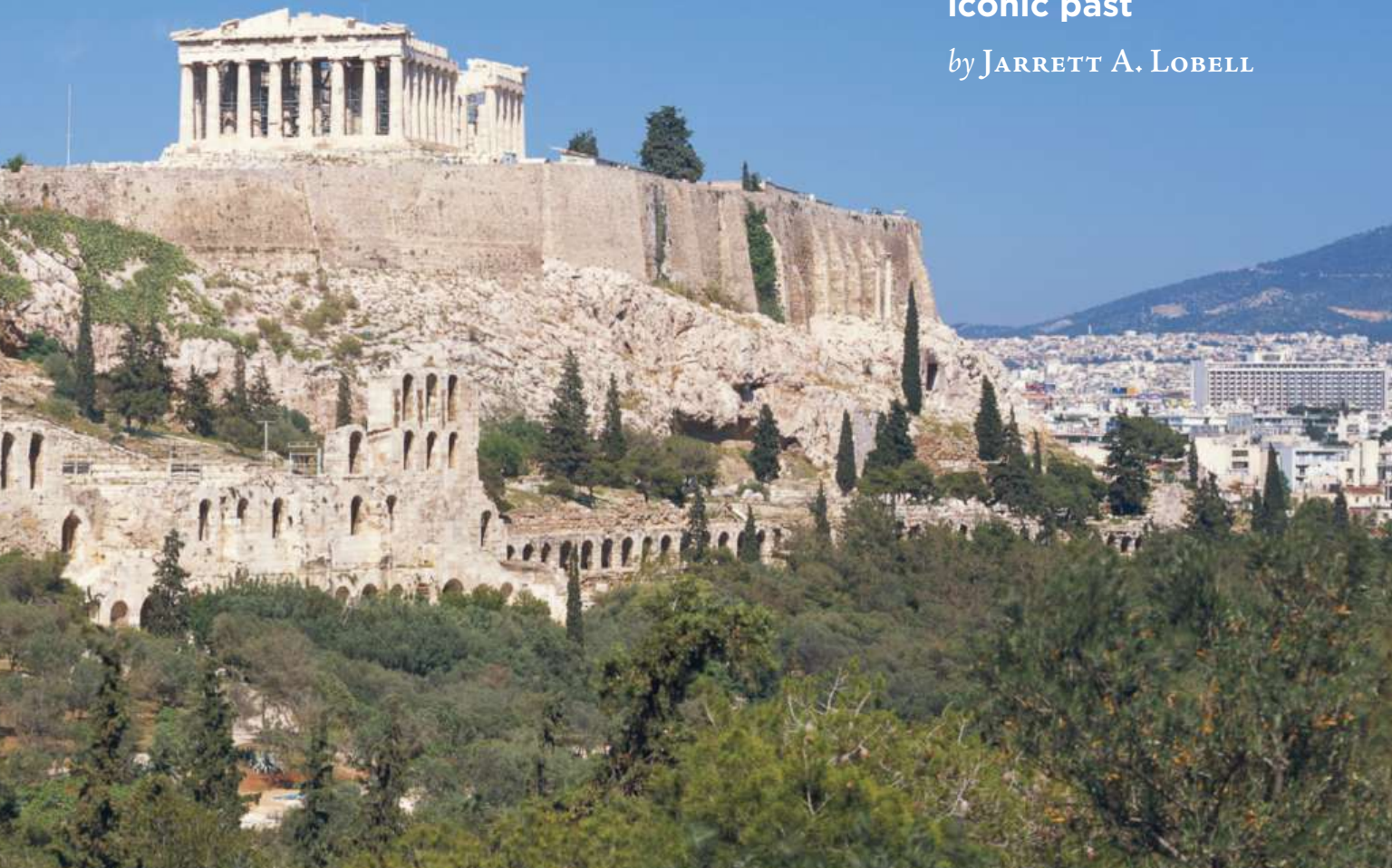
After four decades of intensive work by hundreds of experts in archaeology, architecture, marble working, masonry, restoration, conservation, and mechanical, chemical, and structural engineering, much has been accomplished. Already the restoration of two of the major buildings, the Erechtheion and the Temple of Athena Nike, has been completed, as has much of the work on the Propylaia and on large sections of the Parthenon. In the process, the team has acquired new information about these emblematic buildings. "The Acropolis restoration project has added immeasurably to our knowledge of the fifth-century B.C. monuments atop the Acropolis. Not only has it recovered, identified, and repositioned many once-scattered blocks," says Hurwit, "it has also revealed new features, such as evidence for previously unsuspected windows on the east wall of the Parthenon."

Despite the magnitude of the tasks that remain, Eleftheriou takes both heart and inspiration from the work that she and the team of more than 150 do every day, and also from the ancient artisans who created the Acropolis' monuments. "What I have learned," she says, "is that the ancient architects and engineers faced the same challenges we still do."

of Athens

The decades-long project to restore the site to its iconic past

by JARRETT A. LOBELL



Circuit Walls

5th-century B.C. wall



Although people had been living on the Acropolis since the Neolithic period (ca. 4000–3200 B.C.), it was not until the Bronze Age (ca. 3200–1100 B.C.) that the rock became a fortified citadel with a palace. The first defensive wall atop the Acropolis was built in the thirteenth century B.C. by the Mycenaeans, a civilization that thrived in Greece between about 1600 and 1100 B.C. Long after the Mycenaeans were gone, their wall survived—and some sections still do—until it was severely damaged by the Persians in 480 B.C., after which a new 2,500-foot circuit wall was built as part of the

Optical fiber sensor, north wall



fifth-century B.C. building program. In some places, pieces of monuments destroyed earlier in the century were used.

For more than three decades the circuit walls have been exhaustively documented, con-

stantly maintained, and actively monitored using traditional methods, such as inspecting cracks and removing roots and plants, in combination with the latest and most accurate technology available. A complete photogrammetric survey and 3-D scan of the walls has been completed, optical fibers have been installed to measure strain, and a highly precise nickel-iron alloy underground wire has been placed between the Parthenon and the south wall to measure micromovements.

As part of the conservation of the walls, the limestone and schist of the Acropolis itself was also consolidated. Between 1979 and 1993, unstable rocks were anchored to the main mass of the Acropolis in 22 places with stainless steel rods, and gaps and fissures in the rock were sealed with injections of cement.

Propylaia

Ever since the mid-sixth century B.C., a monumental gateway has stood on the west side of the Acropolis at the entrance to Athena's sanctuary. The original gate was replaced by one that was subsequently destroyed by the Persians and then repaired. The impressive structure seen today—actually three buildings on two different levels—was built between 437 and 432 B.C. by the architect Mnesikles. Many sections of the gate restored by Nikolaos Balanos in the early twentieth century have been dismantled, repaired, and replaced, with much of the recent work focused on the Propylaia's once brightly painted marble coffered ceilings. Now completed, this project required arresting the deterioration of the marble resulting from the iron reinforcements used by Balanos. In addition, 24,00 architectural members needed to be properly identified—including ones that hadn't been used in earlier restorations, fragments wrongly placed, and pieces that required their own restoration—in order to determine what needed to be fashioned anew. As with the other buildings of the Acropolis, the Propylaia was repeatedly used for purposes different from those originally intended—it has been a church, a residence for Frankish dukes, and a garrison and munitions store under the Turks. The most recent effort has succeeded in restoring the fifth-century B.C. experience of entering the Acropolis through an impressively roofed structure, as Mnesikles intended.



Coffered ceiling

Monumental entranceway



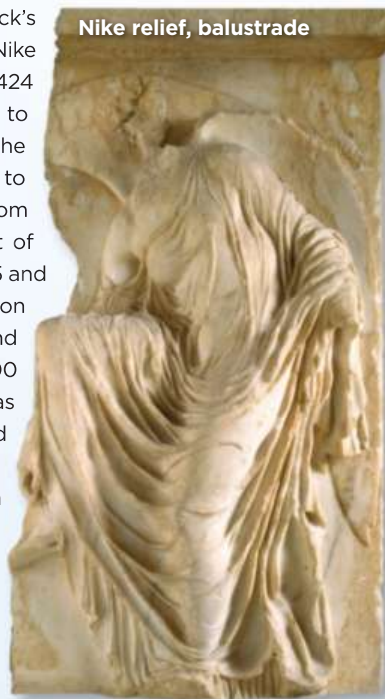
Temple of Athena Nike

Restored north wall



The small marble temple on the rock's southwest corner dedicated to Athena Nike (Victorious Athena), built between 427 and 424 B.C., was the first building on the Acropolis to be restored. In the seventeenth century, the temple was demolished and its stones used to strengthen the Turkish fortification wall. From 1836 to 1845, it was re-erected in the first of three attempts at anastylosis. Between 1935 and 1940, as part of Nikolaos Balanos' restoration work, the temple was again dismantled and put back together, and finally, between 2000 and 2010, the most recent restoration was completed. This last required demolition and replacement of the concrete slab installed by Balanos, upon which the temple sat, with a stainless steel grid, as well as the complete dismantling, restoration, and resetting of all its architectural members. During this process, pieces of column drums and capitals, parts of the coffered ceiling, and blocks of the frieze, cornices, and the pediment were

Nike relief, balustrade



all put back where they had originally been. "We had the opportunity to correct mistakes in the positions of stones from the walls and columns. Balanos had put the best-looking ones in the front, even though some of them had originally been on the back," says architect Vassiliki Eleftheriou. In addition, some fragments that had never been used in previous restorations were identified and set on the building.

The restored temple seen today is not the only monument in this location. As part of the current project, scholars have also conserved an earlier limestone temple to Athena, probably dating to the sixth century B.C., that was discovered in 1936 and that lies beneath the later temple. This earlier structure, along with the base of the cult statue of the goddess also found in 1936, and a tower dating to the Mycenaean period, have been restored and are visible in the basement of the classical structure. Work is currently under way to make this ancient sanctuary accessible to the public.

Erechtheion

Erechtheion, caryatid porch



In many ways, the story of the Erechtheion is the story of Athens. “The Erechtheion was a means to encompass, within its footprint, relics of early Athenian myth and religion,” says classical art historian Jeffrey Hurwit. It was there that the memory of the dispute between Athena and Poseidon over the patronage of the city was preserved in what the Athenians regarded as the impression of the god’s trident, visible through a hole left in the floor of the north porch. That foundational legend was

also preserved in the tales of a sea he caused to well up during the contest, long believed to be under the building, and in the olive tree that Athena caused to sprout on this spot and that marked her victory. And in this location was kept the olivewood statue of Athena Polias (Athena of the City), the Athenians’ most sacred relic, an object so ancient that not even they knew where it had come from.

Since its construction on the Acropolis’ north side between

Arrephorion

Against the Acropolis’ north fortification wall sits a small, square building that Wilhelm Dörpfeld identified in the 1920s as the Arrephorion. (Dörpfeld was the German archaeologist and architect who pioneered the techniques of stratigraphic archaeology and was Heinrich Schliemann’s successor at Troy.) The Arrephorion was the home of the Arrephoroi, two aristocratic girls between the ages of 7 and 11, who were chosen each year to serve in the cult of the goddess Athena. During the festival of the



Arrephoroi, Parthenon

Arrephoria, celebrated at night in mid-summer, the girls enacted a secret ritual in which they carried chests

Foundations



421 and 406 B.C., when it replaced an earlier temple to Athena, the Erechtheion—named after Erechtheus, king of Athens and foster son of Athena—has had a complicated history of use, reuse, destruction, and renovation that mirrors the history of the city. In the fifth century B.C., the unique, asymmetrical structure—its highly unusual shape largely determined by the irregular terrain—served not only as a temple to both Athena and Poseidon, but also as home to the cults of the god Hephaistos, Erechtheus, and the hero Boutes, Erechtheus' brother. The building underwent its first major repairs after it was burned during the Roman general Sulla's siege of Athens in the first century B.C. Since then the Erechtheion has been a church (in the early Byzantine period), a palace for the bishop (during the Frankish period), and a dwelling for the harem of the Turkish garrison commander (in the Ottoman period). Between 1801 and 1812, sculptures, including one of the six caryatids that held up the south porch, were removed to England by Lord Elgin, and during the Greek War of Independence, the ceiling of the north porch was blown up.

The Erechtheion was the first building that Nikolaos Balanos addressed during his Acropolis restoration project, and thus the first place where he employed the techniques that were to prove so disastrous—the use of corrosive iron to reinforce fragile architectural members, the cutting and removal of ancient stones, and the haphazard place-

ment of random fragments to fill in and restore missing sections of the ancient buildings. As a result of Balanos' interventions and the building's repeated recasting, much about its ancient appearance is lost. But between 1979 and 1987, 23 blocks of the north wall that had been incorrectly used to restore the south wall were replaced in their original positions, and new blocks were made for the south wall. This raised the height of the north wall by four courses, bringing it closer to its original height.

Because scholars haven't yet discovered a way to protect the surface of the marble that makes up the Acropolis' major monuments, the remaining caryatids that supported the south porch were removed in 1978 and all were replaced with copies. The originals now sit in the Acropolis Museum, where they were recently cleaned using pulse laser ablation, the same technique that was used on the coffered ceiling of the caryatid porch and

on the west frieze of the Parthenon. This technique, explains Demetrios Anglos of the Foundation for Research and Technology at the Institute of Electronic Structure and Laser in Crete, who oversaw the efforts, involves directing the laser for a short time in a highly focused way and concentrating it on a small volume of material so the dirt is removed in a nondestructive manner. "We do this to clean the marble," Anglos explains, "and to reach a place that is acceptable from both a materials and aesthetic point of view."



Caryatid porch, ca. 1880



Securing loose fragments

above their heads—the contents were and still remain a mystery—and descended the Acropolis, likely by means of a stairway concealed inside the north wall.

While it is known that the Arrephorion, constructed in the fifth century B.C., once had a square hall and four-column colonnade, as well as a rectangular courtyard, all that survive are limestone foundation blocks and fragments of marble. Because the limestone is fragile and the marble cannot be used to restore any extant structure, it was decided that, in contrast to the plans for any other monument on the Acropolis, the Arrephorion would be reburied to protect it. The structure was backfilled in 2006 with soil that could easily be removed if necessary, but is also intended to remain in place for at least 120 years with minimal changes resulting from moisture, seismic activity, or pressure applied to it by contact with the circuit walls.

Parthenon



In 479 B.C. the monuments of the Acropolis lay in ruins, destroyed by the Persians who had sacked Athens in their struggle for control of Greece. Only a few decades later, the conflict with the Persians was over, and, in 448 B.C., the decision was made, initiated by the general and statesman Pericles, to rebuild the temples as a way to celebrate that victory and mark a new era of Greek power, ushering in what has been called the Golden Age. The first to be rebuilt, and the centerpiece of the project, was the Parthenon.

This massive and highly refined temple, dedicated to Athena Parthenos (Virgin Athena), constructed in only nine years with at least 70,000 unique pieces of marble quarried on Mount Pentele almost 20 miles from Athens, was designed by the architects Iktinos and Kallikrates under the supervision of Pheidias, the greatest sculptor of his day. Its sculptural program, completed six years after the building, depicted, among other subjects, mythological scenes, allusions to the Athenians' victory over the Persians, episodes from Athena's life—her birth, her contest with Poseidon for Athens—and the Panathenaia, the yearly festival held in her honor. Inside the temple stood a 30-foot-tall ivory and gold statue, now completely lost, of the goddess

depicted as a warrior and protectress of her city.

The Parthenon has suffered mightily. It remained largely intact for nearly 700 years after it was first built, until it was damaged by fire in A.D. 267. It was later turned into a church in the sixth century A.D., which it remained until 1460, when it was converted into a mosque and a minaret was added. In 1687, gunpowder the Turks had stored in the Parthenon exploded when it was hit by Venetian artillery, causing much of the structure to collapse, and severely damaging other sections. And in 1981, a 6.7-magnitude earthquake caused major harm to the northeast corner. For the restoration team, it is a formidable undertaking to correct nearly two millennia of damage to a building that stands as the symbol of a nation. "Because of the size and weight involved, the challenges are immense," says architect Vassiliki Eleftheriou, "so we started with the most critical problems and went from there. But it's not easy to ever say we're finished with something, because some part is always connected to another part."

Among the most urgent of these problems is the damage caused by efforts at anastylosis by Nikolaos Balanos between the end of the nineteenth century and the beginning of World War II, in particular the poor-quality iron clamps used

Breakage caused by iron clamps



Ongoing restoration, north side



Removal of original metope

to hold together broken architectural members or fasten others in new locations. Over the last century, these clamps have rusted, corroded, and expanded, causing the marble to crack, and even to disintegrate. The Parthenon's ancient builders had also used iron clamps, but had coated them in lead to prevent them from expanding and cracking the stone. Wherever they are found, in the Parthenon and across the Acropolis, Balanos' clamps are removed and replaced with noncorrosive titanium. After more than three decades in some locations, the new titanium clamps show no sign of trouble, says Eleftheriou.

Scattered Architectural Members

Archaeology, and in particular restoration and conservation of buildings and artifacts, is often described as a jigsaw puzzle, and there likely is none more complex than the scattered stone and marble architectural fragments that lie on the Acropolis. Since 1977, the main goal for researchers there has been to photograph, draw, record, and catalogue these fragments in an attempt to associate them with their original structures, and, if possible, to use them for anastylosis. Thus far more than 20,000 worked pieces of stone and marble have been collected, and 10,000 more without worked surfaces have also been recorded. Of these, at least 65 have been attributed to the Propylaea, four to the Erechtheion, 500 to the "Old Temple," (the sixth-century B.C. temple the Erechtheion replaced), more than 120 to the Parthenon's predecessors, and 197 to the Parthenon itself—including many pieces of the "lost" central metopes of the south side of the building, which was blown up in 1687.

This material is also helping re-create a part of the Acropolis' story that is sometimes forgotten. "The classical Acropolis was far more than just the four major fifth-century buildings," says classical art historian Jeffrey Hurwit. "It was a very crowded place filled with a sanctuary of Artemis, another of Zeus, another of a hero named Pandion, the Chalkotheke [a bronze warehouse], and hundreds of bronze and marble statues dating to various periods that must have clogged or encroached upon paths through the Acropolis." Although the remains of many of these ancient monuments are so paltry that true restoration is out of the question, they might remain otherwise little known or even completely unknown but for the scattered fragments that remain. ■

Sculptures, Acropolis, ca. 1865



Capitals after cataloguing

NORTH OF PARIS

Remains of a medieval castle and manor house help tell the story of a powerful French family

by DANIEL WEISS



IN VIARMES, a town in the Oise Valley just north of Paris, archaeologists with France's National Institute of Preventive Archaeological Research were conducting a routine survey ahead of planned redevelopment of the town hall square. There they discovered evidence of a tumultuous period in French history: the

A tile displaying the Chamblay family coat of arms (right), which features three golden scallop shells, was found in the excavation of a manor house in Viarmes, identifying the family as its owner.

The present-day town hall of Viarmes (above left) occupies a château that was built in 1758 on the site where the Chamblays built their manor house more than 400 years earlier.

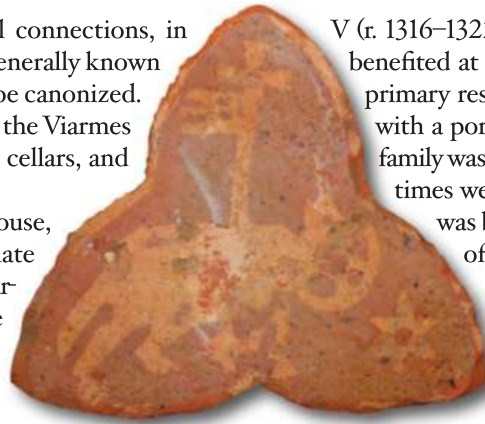
remains of a medieval castle and manor house, both previously unknown.

According to archaeologist François Gentili, head of the Viarmes excavation, the earliest castle walls date to around A.D. 1000, but construction really took off in the late thirteenth century, when the property was acquired by the Chamblay family, whose members served as chamberlains to a series of kings. The Chamblays grew

extremely wealthy through their royal connections, in particular to Louis IX (r. 1226–1270), generally known as Saint Louis, the only French king to be canonized. With their riches, the Chamblys turned the Viarmes castle into a vast complex with towers, cellars, and large mullioned windows.

The Chamblys also built a manor house, outside the castle's moat, with ornate stained glass and tiling. While it was clearly fit to host a royal visit, and while the royal château of Asnières-sur-Oise, less than a mile away, regularly hosted kings of this period, there is no evidence that

V (r. 1316–1322), when they met with disgrace for having benefited at the expense of the national treasury. Their primary residence, near Rouen, was confiscated, along with a portion of their wealth. Gentili notes that the family was able to retain its holdings in Viarmes, but the times were no longer so peaceful. The manor house was burned down, probably during the Jacquerie of 1358, an anti-noble uprising across north-



The corner tower of the castle at Viarmes (below) was rebuilt in the late 14th century to improve defenses after the manor house was burned down.



Decorative features found in the manor house, including flooring made up of square tiles (above) and a trilobed tile depicting Christ as the Lamb of God (top), suggest it was designed to host a royal visit.

the royal court ever descended on Viarmes.

"Viarmes was a residence," says Gentili, "designed for comfortable living in a peaceful period." One of the tiles discovered in the manor house excavation displays the Chambly family coat of arms—which includes a trio of golden scallop shells—identifying them as the owners of the house. The large windows featured in both the castle and the manor house suggest, Gentili adds, that "there was not a concern with defense of the property at this point."

The Chamblys' fortunes shifted during the reign of Philip

eastern France that struck several other grand houses in the area. Soon thereafter, the resurgent Chamblys resumed their position as chamberlains to the king and fortified the Viarmes castle with a rebuilt corner tower and a wider, deeper moat. Near the end of the Hundred Years War, around 1440, however, the main part of the castle was destroyed in a fire. Archaeologists have found part of the moat filled in with pieces of burned stone.

Today, the Viarmes town hall is housed in a château built in 1758 by Jean Baptiste Élie Camus de Pontcarré, a noble who played a prominent role in the court of Louis XV. "Without knowing it," says Gentili, "he chose the same spot to build his château where the manor house of the Chamblys had stood 400 years earlier." ■

Daniel Weiss is a senior editor at ARCHAEOLOGY.

IN THE HARSH LANDSCAPE between the stark Hijaz Mountains and the vast Nefud Desert in northwestern Saudi Arabia, the very existence of the town of Tayma hinges on a quirk of geology. This is one of the world's driest places, receiving less than four inches of rain annually on average. Yet until about 6,000 years ago, when the climate turned from wet to arid, a saltwater lake covered eight square miles on the northern fringe of what is

now a lush oasis. While today that lake is a forbidding salt pan, or *sabkha* in Arabic, its ghost remains in the form of an aquifer that rises close to the surface on its southern edge. Even in the hottest and fiercest summers, when no precipitation falls and temperatures regularly top 115 degrees Fahrenheit, farmers here can depend on shallow wells for a seemingly endless flow of cool, fresh water for their luxuriant gardens and shady date palm plantations.



At the site of Tayma, excavators work at an area outside what is thought to have been the settlement's temple. A deep well now covered in wood (far right), may have been connected to it in antiquity.

This unceasing bounty in an inhospitable land made Tayma famous. For millennia, merchants and missionaries, kings and caravans, halted here to refresh themselves and their animals and to take on provisions for the hard journey through the desert to Egypt, the Mediterranean coast, Iraq, or Yemen. The settlement, also called Tema in ancient records, earns a passing mention in the Old Testament for its wells: “The inhabitants of the land of Tema brought water to him that was thirsty,”

says the book of Isaiah, perhaps a reference to Bir Hadaj, the largest, most famous, and possibly oldest working well on the Arabian Peninsula, which sits in the middle of Tayma’s old town and still supplies water to some of its residents. Local lore places the well’s origin in the third millennium B.C., although there is no archaeological evidence to date it. Yet it must have been such wells that watered the gardens that made Tayma green year-round since before recorded history.



Where the Wells Never Go Dry

In a remote corner of Saudi Arabia, a team has been excavating the remains of the ancient oasis of Tayma

by ANDREW LAWLER



The Bir Hadaj, perhaps the oldest well on the Arabian Peninsula, has been in use for thousands of years and was recently restored under the leadership of Muhammad al-Najem and the Saudi Commission for Tourism and Antiquities.

For some, Tayma may be best known as the temporary seat of power of one of the ancient world's most enigmatic rulers. Cuneiform tablets and inscriptions record that, in the sixth century B.C., Babylon's King Nabonidus left what was then the largest and wealthiest city on Earth for this obscure oasis. He returned home a decade later, only to lose his empire to the Persians, effectively ending 2,500 years of Mesopotamian civilization. Little else has been widely known about Tayma before or after Nabonidus' ignominious end as a Persian captive. However, it has a surprisingly rich history, dating back more than 3,000 years before the king's arrival, which has captured the attention of a Saudi-German research team managed by the Saudi Commission for Tourism and Antiquities. Overseen by Ricardo Eichmann and directed by Arnulf Hausleiter, both of the German Archaeological Institute (DAI), with the support of the commission's Tayma chief Muhammad al-Najem, in 2004 the team began the first comprehensive excavations at what has become the country's largest archaeological site. Tayma's main mound covers more than 200 acres, and is now fenced off from palm groves and the encroaching modern town.

Temples decorated with Egyptian statues, South Arabian inscriptions, and carvings with Mesopotamian motifs attest to Tayma's cosmopolitan nature.

Archaeologists have found hundreds of thousands of pieces of worked flint at Tayma. They were used by the ancient inhabitants to make drills to bore holes in carnelian beads manufactured at the site.

Piped-in water once splashed through one large sanctuary where it pooled in massive carved-stone troughs outside the doors, perhaps for ritual ablutions. Rock carvings from the area, dating at least to Nabonidus' time, suggest that the people of Tayma were literate, wealthy, and well traveled. What the excavators are uncovering is reshaping not just our understanding of this remote location, but also how trade operated in the ancient Middle East, spreading ideas and beliefs as well as goods. "Tayma is an incredibly important site, and scholars are scarcely aware of its significance," says Daniel Potts, a New York University archaeologist specializing in ancient Arabia, Mesopotamia, and Iran.

THE SABKHA ITSELF, just north of Bir Hadaj, is flat and featureless. But thousands of years ago, even as it dried up, it drew people to its salty shores. Over the past two field seasons, archaeologist Max Haibt from the Free University of Berlin has uncovered thousands of unfinished

carnelian beads and hundreds of thousands of pieces of worked flint that, according to radiocarbon dating of charcoal associated with the stones, date back as early as 4000 B.C. In one trench measuring only three feet square and six inches deep, Haibt excavated 700 flint drills used to bore holes in the carnelian. Yet after surveying the area, he found only 10 finished beads made from the deep-red stone that was highly prized across the ancient Near East and Indian subcontinent. Haibt believes that large numbers of artisans were producing these exotic manufactured goods to sell elsewhere. Based on the shape of the beads and the quality of the carnelian, he suspects that the market in this era was pre-Dynastic Egypt, where large numbers of carnelian beads have been discovered in tombs. If he's correct, it would provide evidence that Arabia and Egypt may have been linked by trade long before the rise of the Old Kingdom around 2700 B.C. That Tayma was part of an international trade network six mil-

Although very few carnelian beads have been found, excavators have uncovered thousands of unfinished examples.



lennia ago, producing luxury goods for export, is surprising. Although Jonathan Kenoyer, an archaeologist at the University of Wisconsin–Madison, is skeptical of Haibt’s theory, given that carnelian was worked in the fourth millennium B.C. at Egyptian sites such as Hierakonpolis, the sheer numbers of unfinished beads at Tayma impress him. “This may have been one of the big production centers that supplied the Arabian Peninsula, and probably also parts of Mesopotamia and the Levant, with carnelian beads,” Kenoyer says.

Aside from the scatter of beads, little is known about the early settlement. Hausleiter and his team explored the edges of the sabkha and found no architecture. They did, however, find remains of oat, millet, wheat, and barley cultivation dating from the third millennium B.C., as well as evidence of olives, grapes, and figs, all of which require irrigation. This suggests



Several artifacts found at the site, including this object bearing King Nabonidus’ name, attest to the likely presence of Tayma’s most famous resident, the last king of the Babylonian Empire.

that Tayma was likely an established settlement centered on wells that provided life-giving water for farms. That may signal a need for a change in thinking, since most scholars have assumed that interior Arabia consisted mainly of small bands of herders and hunters until domestication of the camel after 1000 B.C.

Extending along the southern edge of the sabkha is Tayma’s most enduring and mysterious feature: a sandstone and mud-brick wall that runs an astonishing 11 miles, punctuated along the way with sturdy rectangular towers. The wall encloses more than 2,000 acres, and, in places, still stands as high as 25 feet. Celebrated in texts written by medieval Muslim travelers, it may have functioned as a defensive perimeter, a dam to prevent an incursion of saltwater from the sabkha during rare heavy rains, a corral for animals, or a combination of all three.

Historians and archaeologists had long thought that the wall, given its tremendous size and extent, was likely built during the time of Nabonidus, or perhaps even later. When Hausleiter’s team sampled sediments at the foot of one section and used optically stimulated luminescence to determine how long it had been since the sun shone on the base, the results were wholly unexpected. Parts of the wall were created during the Bronze Age, between 2500 and 2000 B.C., during the heyday of Egypt’s Old Kingdom, Mesopotamian city-states such as Ur, and the distant Indus Valley civilization, according to Nicole Klasen from the University of Cologne. The towers, says Hausleiter, date to as early as 1900 B.C. “The new data from northern Arabia, particularly Tayma, fundamentally challenges this reconstruction of settlement history in this area,” adds

Bryn Mawr College archaeologist Peter Magee. The dating indicates that Tayma—and possibly other Arabian oases—was a bustling, wealthy, and sophisticated town a thousand years earlier than scientists once suspected.

Yet the Saudi-German team has uncovered frustratingly little evidence of the people who lived at Tayma during this period. An ax and a ribbed dagger found in a modern industrial area by Saudi archaeologist Mahmoud al-Hajiri likely date to the time of the wall and tower construction, and have parallels in Syria and the Levant, but weren’t found in a datable context, and might have been brought there long after their production. On the south side of the mound, excavators did locate skeletons in graves from this era. The bones are badly deteriorated and have yet to yield much data, though the pottery in the graves suggests they come from the same time as the wall construction. Specialist Emmanuele Petiti of the DAI says that some arm bones show signs of continuous muscle stress, a hint that at least some of the townspeople engaged in repetitive physical labor. Petiti is hopeful that additional analyses will provide clues to this period when Tayma could brag of having one of the ancient world’s most extensive walls.

TAYMA’S TIES TO the outside world before and during the Bronze Age are intriguing but unclear. With the dawn of the Iron Age in the twelfth century B.C., however, the picture sharpens. In 2010, Saudi archaeologists found an inscription bearing the name of the Egyptian pharaoh Ramesses III (r. 1187–1156 B.C.) on a rock face outside Tayma, the first pharaonic inscription found in Saudi Arabia. It matches similar examples found on a trading route passing from the Nile across the Sinai and into what



The name of the 12th-century B.C. pharaoh Ramesses III was discovered on a rock face just outside Tayma and is the first example of a pharaonic inscription found in Saudi Arabia.

Egyptian artifacts, including this scarab with a human face (right) and a fragment of a faience bull statuette (below), have been uncovered at Tayma, evidence of contact with Egypt throughout the settlement's history.

is now Jordan. Tayma by then was part of an organized long-distance network. A couple of centuries after Ramesses' reign, the domesticated camel began to make large caravans across forbidding desert terrain possible. Frankincense that could only be produced in southern Arabia, in what is now Yemen and Oman, could be carried in large quantities to the temples of Egypt and Mesopotamia using well-watered Tayma with its protective walls as a stopping point.

Evidence shows that Tayma's prosperity and international contact continued to increase between the twelfth and ninth centuries B.C. On the southwestern edge of the site, archaeologists found a building that Hausleiter believes was a temple. It measures 40 by 65 feet, with pilasters and a paved forecourt, all protected by a six-foot-thick wall. Within, they found the remains of bone, ivory, wood, and faience objects such as amulets, gaming pieces, and glazed vessels, as well as statues of Egyptian deities and a scarab with a human head, attesting to close relations with Egypt during and after the reign of Ramesses III.

Centuries later, the temple was covered by a cemetery of rock-cut graves that may provide some insight into the lives of Tayma's residents in the Hellenistic era of the fourth and third centuries B.C. Currently Petiti is working on the bones of 62 individuals from this period. What impresses him the most, he says, is the health of the people buried in these tombs. "Perhaps they didn't have to work that much, and they had regular and high-quality food," Petiti says. This may be why he has found little evidence of tooth decay. Furthermore, he explains, women appear to have had a better lifestyle than men, since female bones show less stress and fewer incidents of trauma. The team has also found stone friezes from this era that show women feasting. These discoveries hint at a society where women may have played a larger public role than in neighboring Mesopotamia or Egypt.

Assyrian inscriptions show that, by the eighth century B.C., Tayma was even more closely linked with the lands beyond it. The oasis emerged as a key stopping place for caravans traveling between Egypt and Mesopotamia, and to and from southern Arabia. The settlement grew rich on this regional trade. Assyrian kings claimed that Tayma paid them tribute through the Desert Gate of Nineveh, the one-time capital of the Assyrian Empire in what is now the Iraqi city of Mosul. The sixth-century B.C. Hebrew prophet Jeremiah prophesied against the city's wealthy merchants, and the Book of Job, which likely originated in this period, mentions the city's caravans. Tayma drew even more international attention in 556 B.C. when Mesopotamian texts say that the king of the

biggest power on Earth settled here for a decade during what proved to be the twilight of a mighty power. But aside from some stone grave chambers dating from 1000 to 500 B.C., surprisingly little from this era has been found.

NABONIDUS' MOVE TO what historians assumed was a remote desert oasis at a critical time in Babylon's history has long intrigued and divided scholars. There is evidence from contemporary texts that Nabonidus favored the moon god Sin over Marduk, the king of the Babylonian pantheon. This earned him the enmity of the powerful Marduk priesthood, and he fled to this desert retreat. His departure, at a time when Persians and Medes (a people from what is now Iran) threatened the empire to the east, has been seen as foolish, cowardly, or a sign of mental illness. Other texts suggest that Nabonidus may have been physically sick and seeking a place to recover.

The Saudi-German team has not located Nabonidus' palace at Tayma, which is mentioned in at least one ancient text—stones from structures of his day were likely reused in later times, so they may be lost forever. The archaeologists have, however, found a number of inscriptions pointing to the king's presence. For example, a stone stela uncovered at the site records that Nabonidus furnished a temple in Babylon, which suggests that he kept close track of the empire and its capital from Tayma. The excavations demonstrating Tayma's economic muscle also provide a new way of understanding the king's retreat to a distant desert oasis. Given the importance of Babylonian trade with Arabia, the Levant, and Egypt, Nabonidus might have been seeking to strengthen



A mid-6th-century B.C. sandstone stela, showing Babylon's King Nabonidus, was found in debris near one of Tayma's main temples, a further indication of the time the ruler spent at the oasis.

ties and secure routes threatened by nomadic tribes at a time when his empire's economy was flagging. "By conquering Tayma"—as well as other cities in the area—"Nabonidus gained control of the northern parts of the western routes of the frankincense trade," says Michael Macdonald, a University of Oxford specialist in ancient Arabian languages.

NABONIDUS ABANDONED TAYMA in 543 B.C., and his empire collapsed soon after. But the oasis continued to flourish, even as it became embroiled in power struggles with neighboring towns and kingdoms. On top of a 30-foot-high mound, the DAI's Sebastiano Lora has been attempting since 2006 to piece together the history of the temple that dominated the latter days of ancient Tayma. Unlike the older temple to the south, this site is a puzzle of fallen stone reused over generations. "This is my dream and my nightmare," he says. In the narrow trench at one end of the temple, he has found pottery dating to Nabonidus' era, as well as finely hewn stone. After 400 B.C., the building was reno-



Called the "al-Hamra cube," this sandstone pedestal or altar found at Tayma dates to the 5th or 4th century B.C. and depicts ritual scenes combining elements of local, Egyptian, and Mesopotamian artistic styles.

vated and expanded to cover more than 5,000 square feet. The imposing structure, with its view of the sabkha and mountains, had large stone pillars, three niches, eight-foot-thick walls, and a 12-foot-wide entrance leading to a monumental terrace with enormous stone steps and carved stone basins, as well as large stone statues of a distinctly Arabian style.

Another part of the team, led by Alina Zur, recently excavated a tunnel, almost high enough to walk through, that connects the east side of the temple with a deep well a few dozen yards away. "We have a lot of questions to resolve," she says. "A stela was reused to cover the tunnel. And this was clearly



Archaeologist Alina Zur examines a frieze of rosettes and animals that was reused as a funeral stela in the 1st century A.D.

a group effort in antiquity—we needed a heavy-duty crane to move some of these slabs." The water features, which, Lora says, "define the building," are still not well understood, but they point to the influence of the Nabataeans, who created a large trading empire in the late centuries B.C. and early centuries A.D., centered in Petra, the rock-cut city just across the border in Jordan.

Just south of the temple is a maze of residences built in a variety of styles over the centuries, from Nabataean times until the Byzantine period of the fifth and six centuries A.D. Some houses had two stories, some rooms have no doors, and one can only be accessed by a hole in the roof. "There is pottery from every period," says the DAI's Friedrich Weigel. "And there is a late Roman courtyard house that is completely different from the other buildings." He adds that the residential area seems to shift to the north over time, possibly because access to the plentiful underground water gradually migrated in that direction. Eventually, the temple was converted into makeshift dwellings before being abandoned shortly thereafter. By A.D. 600, just before Islam swept up the peninsula from Medina and Mecca, the residents of Tayma moved their settlement a few hundred yards as the water table continued to move northward. The ancient city was left to the sun, the blowing sand, and archaeologists. Hausleiter hopes to work at the site for many years to come in order to grasp how Tayma evolved and to gain further insight the settlement can provide into a much wider area. "Our goal is to understand a region that is fully connected to other parts of the ancient Near East, and our work shows that Tayma is not just a distant place on the periphery of Egypt and Mesopotamia," says Hausleiter. "Now we know that the old idea that Arabia was a desert wasteland doesn't work anymore." ■

Andrew Lawler is a contributing editor at ARCHAEOLOGY.





Eternal Banquets of the Early Celts

An extraordinary 2,500-year-old tomb offers vital evidence of trade, ritual, and power in fifth-century B.C. France

by JASON URBANUS

THE CELTS ARE CONSIDERED the archetypal cultural group of the Iron Age in central and western Europe. Their influence spread from Iberia to Romania, from the British Isles to Asia Minor, and yet details about their origins and development remain obscure. One of the most indelible archaeological characteristics of Early Iron Age Celtic society—large, elaborate burial mounds—is also one of the best sources of information about these people. The recent discovery of a tumulus in Lavau, France, is adding greatly to knowledge of the most transformative period in early Celtic history. While today we may think of the descendants of the Celts as residing along the fringes of western Europe, in places such as Ireland, Scotland, Wales, and Brittany, this is somewhat misleading and partially influenced by a wave of eighteenth- and nineteenth-century Celtic romanticism and revivalism. Archaeologically speaking, the people whom the ancient Greeks first called the *Keltoi*, and whom the Etruscans and Romans also encountered, hailed, instead, from central Europe.

SINCE 2014, ARCHAEOLOGISTS from France's National Institute of Preventive Archaeological Research (INRAP) have been working in the village of Lavau, near Troyes, in north-central France. Located a mile north of the River Seine, the scenic valley has a rich and well-documented archaeological history. According to Bastien Dubuis,

A depiction of the Greek river god Achelous decorates a handle of an enormous bronze wine cauldron of Mediterranean origin discovered in a 5th-century B.C. Celtic tomb.



Archaeologists working in Lavau, in north-central France, have uncovered a monumental ancient necropolis with burials dating back to the Bronze Age. At its center is a tumulus containing one of Europe's richest Early Iron Age burials.

director of the excavations, “The site has been known since the 1960s, when a local archaeologist spotted an abnormal hillock and presumed that it corresponded to a funerary monument or burial mound.” Over the next few decades, as Lavau grew both commercially and residentially, archaeologists surveying the area began to get a better glimpse of a remarkable ancient necropolis spread over 75,000 square feet. INRAP archaeologists are responsible for more than 2,000 investigations a year in culturally sensitive areas of France slated for construction, but, even for them, the examination of the hillock in Lavau would turn out to be anything but routine. Although the team had discovered dozens of graves nearby, some dating as far back as the Bronze Age (1300–800 B.C.), it was a 130-foot-diameter tumulus that stunned the investigators. The early fifth-century B.C. grave contained a wealthy individual dressed in gold jewelry, along with an almost entirely deteriorated two-wheeled chariot and exceptional grave goods, including Greek and Etruscan bronze and ceramic vessels. “It is almost supernatural,” says Dubuis, “that it stayed hidden for so long, in everybody’s view, in the middle of factories and houses. It is one of the richest Celtic graves in Europe.”

Although the 140-square-foot subterranean burial chamber had collapsed under the weight of the hill above, the grave and its collection of artifacts were well preserved, having escaped the notice of looters, who have stripped so many large Iron Age burials. Dozens of exquisite objects, none more striking than a large decorated bronze wine cauldron, were strewn around the tomb. The vessel, either Greek or Etruscan in origin, demonstrates outstanding craftsmanship and measures more than three feet in diameter. Each of its four large circular handles bears what is believed to be a representation of the Greek river god Achelous, complete with long pointed beard, mustache, horns, and a bull’s ears. Eight lioness heads decorate the cauldron’s broad rim. Discovered buried within it was a Greek ceramic *oinochoe*, or wine pitcher, painted with a black-figure

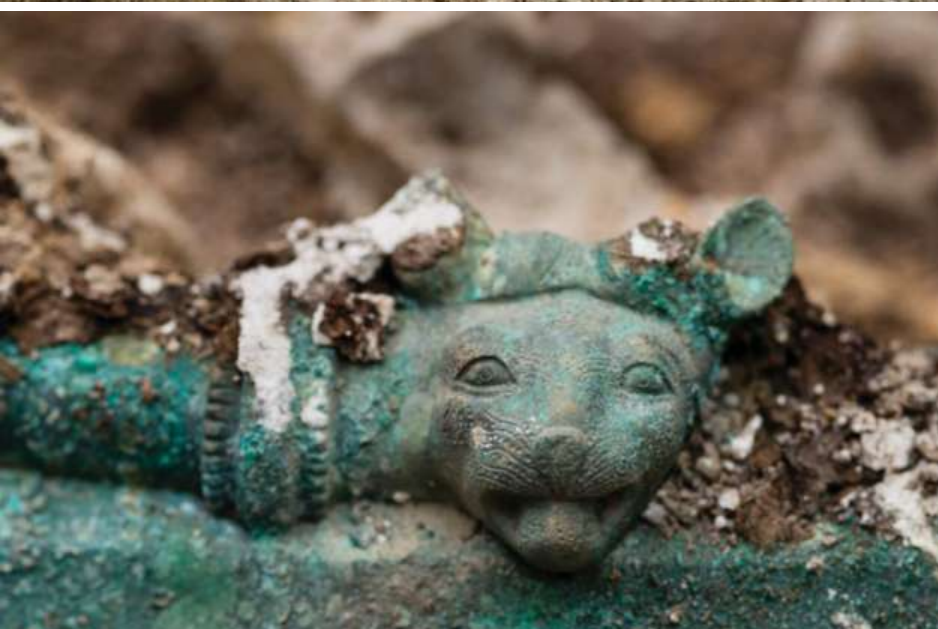
banqueting scene that features Dionysius reclining beneath a vine opposite a female figure. The lip and foot of the pitcher are decorated with gold trim, a rare aesthetic detail for objects found in this region. “Imported from a great distance—Italy, Greece—these remarkable masterpieces required great technical know-how,” says Dubuis. While elaborate graves, full of high-quality imported goods, are rare in Iron Age France, they are not altogether unknown. According to Dubuis, the tomb’s lavish artifacts point to it having been the burial place of an individual who was a key member of society. Within that society, the rituals associated with the acquisition, distribution, and consumption of alcohol, in both life and death, were a priority. And, beyond that, it demonstrates that early Celtic societies were firmly entrenched in an extensive Mediterranean-wide trade and exchange system.

IT IS GENERALLY AGREED that by the end of the first millennium B.C., distinct Celtic languages, artistic styles, and even sociopolitical structures had spread throughout much of Europe. Determining the origins of these diverse people and whether they would have considered themselves part of a related cultural group known as the Celts is more complicated. In recent years, the term “Celts” has been a point of contention among scholars, as some would argue against the notion of a homogenous Celtic culture spreading throughout Europe. At the least, it is probably best understood that the term “Celt” contains some ambiguities, and should be used to describe a widespread group of people who shared common material culture, language, and symbolism, but had distinct regional differences. “We can definitely say that none of the people who inhabited the sites we excavate in west-central Europe in the pre-Roman Iron Age would have recognized the term ‘Celt’ or ‘Celtic,’” says University of Wisconsin–Milwaukee archaeologist Bettina Arnold, “and they would certainly not have used it to describe themselves.” A major difficulty for historians and archaeologists is that the Celts never wrote about themselves. It was only centuries later that other civilizations such as the Greeks and Romans began to document their existence, but by then details about these “barbarians” were muddled with biases and inaccuracies.

Although there are competing theories, it is traditionally believed that the Celts emerged from two European Early Iron Age cultures, known as Hallstatt and La Tène. The Hallstatt culture (ca. 800–475 B.C.) is named after a village in upper Austria where, in the mid-nineteenth century, archaeologists discovered a vast Iron Age necropolis containing nearly 1,000 graves dating to the seventh and sixth centuries B.C. The burials contained weapons, jewelry, pottery, and personal items, artifacts that have come to characterize the culture that developed in this region north of the Alps, from eastern France to western Hungary, and that is often considered the earliest precursor of Celtic culture.

The later La Tène culture (ca. 450–first century B.C.) is named after an archaeological site in Switzerland, where thousands of artifacts were discovered in a lakebed. The metallurgy, weapons, art, and lifestyle of the La Tène culture more closely

(Clockwise) A wealthy individual (pictured here) lies near the bronze wine cauldron; a black-figure Greek *oinochoe* uncovered within the cauldron; detail of the cauldron's rim and handle; an archaeologist excavates the cauldron; detail of one of eight lionesses that grace the rim.



resemble what we have come to think of as “Celtic.” Their territory was located on the western fringes of the Hallstatt region, centered in an area that spread from northeastern France to southern Germany and Switzerland. Archaeologists believe that the emergence of the Celts takes place in this area sometime near the end of the Hallstatt period and the beginning of the La Tène, between 600 and 400 B.C. Arnold characterizes the society there as “agro-pastoral” and believes that it was, to a degree, hierarchical. “Some communities seem to have achieved quite significant population levels—5,000 people at Heuneburg—but most people,” she says, “still seem to have lived in small hamlets or even isolated farmsteads.”

The mound in Lavau is one of a series of elite burials that appear around 600–450 B.C., often referred to as “Celtic prince graves.” These are characterized by their monumental size, elaborate layouts, high-quality grave goods, entombed vehicles, and imported drinking vessels.

The Lavau burial has three significant components: the body, a two-wheeled chariot, and the luxurious wine and feasting assemblage. A characteristic Celtic adornment, a solid gold torque, remains around the deceased’s neck. Weighing over one and a quarter pounds, the piece is decorated with a double motif of a winged monster and pear-shaped terminals. Two gold bracelets also remain around the wrists and a jet armlet around the left biceps. Dubuis says, “The character buried here had to be at the top of the local aristocracy.”

Exactly how this class of early Celtic elites emerged is uncertain, but judging from elaborate burials such as Lavau, it appears their status was in part created, maintained, or reinforced by their connections to broader Mediterranean trade and trade goods. “The higher status burials contain more metal feasting and drinking equipment, and it is more often imported,” says Arnold. Those at this level of Celtic society, in displaying such luxurious items, both in life and in death, would be demonstrating their connection to distant peoples and sources of power.

During the sixth century B.C., contact between Greek and Mediterranean traders and inland early Celtic communities sharply increased. This was due in large part to the founding of the Greek colony of Massalia (now Marseilles) near the mouth of the Rhône River around 600 B.C., which established a stable trade corridor along the Rhône and its secondary river systems that led into the developing Celtic frontier. Greek and Etruscan merchants sought precious metals, amber, furs, timber, and slaves from northern Europe, all of which the Celts traded, mostly in exchange for wine. Although early Celtic societies brewed their own alcoholic mead and ale beverages, wine was a new and sought-after commodity. As trade with the Mediterranean increased, amphoras, drinking cups, mixing vessels, and other paraphernalia associated with wine consumption were gradually introduced to Celtic communities through the major river valleys.

Lavau was positioned so that Greek goods might be accessible from routes along the Saône and other rivers that flowed toward the Mediterranean coast. But it also occupied an important central position between Etruscan trade routes

from over the Alps and tin sources along the Atlantic coast and southern Britain, a location highly desirable to the Celts’ Greek and Etruscan trading partners. While prestige goods were certainly acquired during the trade and exchange process, some of the higher quality vessels were probably given to the Celtic elite by Greeks and Etruscans as diplomatic gifts to secure political alliances.

It is clear from tombs of the elite, and even the graves of lesser individuals, that the rituals associated with drinking parties were an integral part of early Celtic societies. The exceptional collection of artifacts from the Lavau burial contains all the necessary accouterments to welcome the dead into the afterworld with a terrific banquet. Besides the large bronze cauldron and black-figure oinochoe, archaeologists found other bronze basins, serving vessels, and a silver sieve used to strain residues or added spices from wine. “[These



The elite individual's remains were found with jewelry, including a gold torque, gold bracelets, and a jet armband.

vessels] are not only proof of an exchange of tangible assets,” says Dubuis, “but certainly also of exchanges of culture, knowledge, and politics.”

While the discovery of the Lavau tomb illustrates the importance of Mediterranean wine culture in early Celtic societies—and also in the afterlife—according to Arnold, alcohol was already a fundamental part of Hallstatt culture,

even before the introduction of Mediterranean wine. “Alcohol served as a social lubricant as well as a means of binding followers to their social superiors, however that status was defined, at various levels within the hierarchy,” she says. The use of alcohol is simply expressed differently in the archaeological record with the advent of Mediterranean trade and the introduction of higher quality ceramic and metal vessels. “The key to understanding the significance of these drinking sets,” says Arnold, “appears to be linked to the hospitality and generosity required of elites in this society, irrespective of gender.”

According to Dubuis, organizing feasts and distributing wine was a vital responsibility for Hallstatt chieftains, and a mechanism to not only demonstrate but also bolster their status. “Not everyone had access to alcohol,” Arnold says, “and it seems to have been dispensed in politically strategic ways by elites to their followers.” Dubuis believes the acquisition of precious



and exotic cauldrons allowed the Celtic elite to strengthen their power even further. These vessels—which could contain enough wine to quench the thirst of dozens of people—were used during public banquets, ceremonies, and political meetings.

While the early Celts may seem to have been quick to imitate the outward appearance of the Greek symposium, or drinking party, the rituals associated with their own consumption and distribution of alcohol maintained their underlying indigenous character. Although objects associated with wine appear to have been used across cultures in the same way—they are very important for the public banquets of the

Mediterranean—they were not necessarily used for the same reasons. Dubuis says, “The society and the political system of the Celts were different.” The Lavau burial continues to yield information about what those differences might have been.

Although the initial discovery of the tomb was hailed by many media sources as that of a Celtic “prince,” according to Arnold, statements about the individual’s gender are premature. The condition of the bones made early analysis of the skeleton inconclusive. However, some of the jewels and costume accessories, such as amber beads and iron and coral garment hooks, suggest the remains belong to a Celtic “princess.” “What is intriguing about Lavau is that there are no weapons in the grave,” says Arnold. A single knife was found in association with the feasting and drinking equipment, and not on or near the body, as would be expected for a dagger. “The personal ornamentation,” she says, “appears to be consistent with that of a female individual.” If this is confirmed by DNA analysis—testing is scheduled in the upcoming months—it could have reverberating effects on knowledge of the role of women in early Celtic society. “What the source of her wealth and power may have been is not yet clear,” says Arnold, “but it was certainly a combination of birth and ability.” Elite female graves from this period are rare, but not without precedent. The best known of these is the famous Lady of Vix, just 40 miles from Lavau. Arnold says, “There is some reason to believe that there was a change at the beginning of the La Tène period in the ability of women to achieve power in their own right.”

THE AGE OF THE GREAT elite Hallstatt Celtic burials faded in the decades following the construction of the Lavau tumulus. The archaeological evidence from the later Iron Age indicates a somewhat less socially stratified society with decidedly fewer elaborate burials. The next centuries are characterized by the emergence of a “warrior aristocracy,” the development of an original Celtic art style, the migrations of the Celts, and the spread of Celtic culture. In 390 B.C., the Celts sacked Rome. In 279 B.C. a group attacked the oracular sanctuary at Delphi in Greece. Eventually, the Celts and Celtic culture would extend from Asia Minor to Iberia. During their inevitable collision with the Roman world, the first detailed descriptions of Celts, or as they were known by the Romans, Gauls, make their appearance. The last great stand of the continental Celts took place not far from Lavau at Alesia, where an army led by Vercingetorix was defeated by Julius Caesar in 52 B.C. Thanks to the Romans and their habit of effusively recording history, many details about the end of the Celtic story are known, but in order to understand the beginning or even the middle, discoveries such as Lavau are crucial. “The excavation of Lavau is going to allow us to move forward in numerous domains,” concludes Dubuis. “This grave is fantastic, not only because it is one of the richest in all the Celtic world, but also because of its remarkable state of preservation. The chance to examine such a monument arrives only once a century.” ■

Jason Urbanus is a contributing editor at *ARCHAEOLOGY*.



Where There's Smoke...

Learning to see the archaeology under our feet

by SAMIR S. PATEL

Victoria Weigold, then a student at Connecticut College in New London, collects cigarette butts outside Ernie's Cafe as part of a project to understand how these ubiquitous pieces of litter might reflect social identity.

ONE MORNING IN 2008, while waiting for a light to change at the corner of Wilshire and Sepulveda Boulevards in Los Angeles, archaeologist Anthony Graesch jumped out of his pickup truck. In the 75 seconds between green lights, much to the mystification of his fellow commuters, he swept all the garbage—primarily hundreds of cigarette butts—that had accumulated against the curb of the median into a 10-gallon trash bag. Graesch tossed it into the truck bed, hopped back in the cab, and continued to his office at the University of California, Los Angeles, where he was a postdoctoral researcher in anthropology and archaeology.

Like many archaeologists, Graesch says, he looks down a lot,

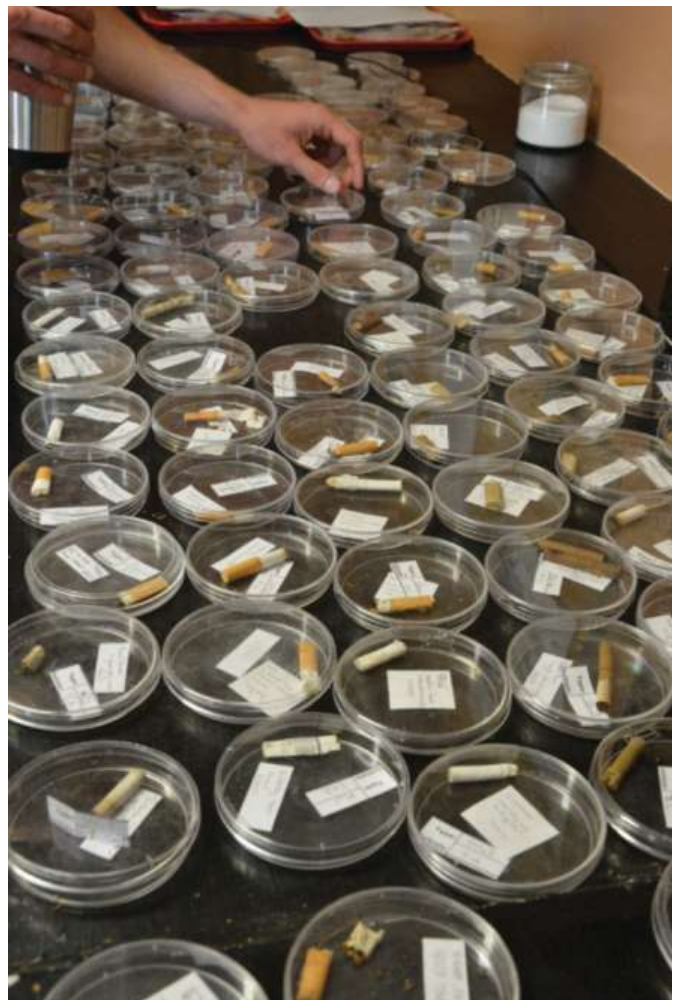
reflexively observing the bits of urban flotsam around him, and he had developed a minor obsession with cigarette butts. “I couldn’t stop seeing them,” he says. A few years later, when he took a full-time position at Connecticut College in New London, where he is now chair of the anthropology department, this interest and that bag of L.A. curbside trash went cross-country with him.

Garbage has long been a critical part of the human material record to archaeologists, middens, privies, and trash heaps are consistent sources of knowledge, full of bones, potsherds, broken tools, pipestems, and more, across the world and throughout human history. “It’s pretty much the bread and butter of archaeological research,” says Graesch—so much so that when archaeologists began to look at the contemporary world, garbage



was a natural target. In the 1970s, William Rathje, a legendary archaeologist at the University of Arizona, pioneered the field of garbology, or the study of modern waste using archaeological methods. There have been many other examinations of modern artifacts, but decades later Rathje's work remains the most cited example of archaeology of the contemporary—how modern material culture reflects behavior and society.

Graesch's impulse to collect trash, which grew from the work of Rathje and others, has again brought the archaeological eye to modern rubbish and is providing a useful approach for teaching theory and methods to his undergraduate students. Among the challenges of teaching archaeology, Graesch explains, is demonstrating why archaeology matters. Modern

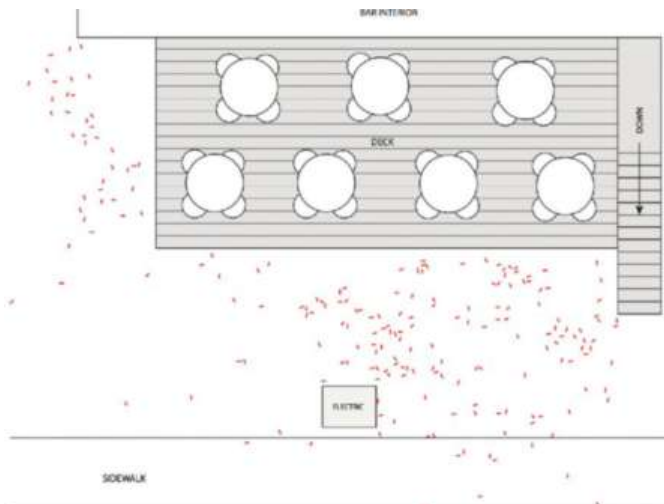


Back in the archaeology lab, cigarette butts collected by students are organized by provenience and type.

artifacts, he has found, can help illustrate how behavior relates to community and how modern questions and problems appear, and can be studied, in the material record.

IT'S LITTLE SURPRISE THAT Graesch saw cigarette butts everywhere upon his arrival in Connecticut. He observed that they were clustered around the town's high concentration of bars, each with its own style: sports bars, biker bars, rock 'n' roll bars, gay bars, an Irish pub, and others. This got him thinking about drinking establishments and how a small city such as New London could support so many. They are places where people congregate primarily for social purposes—a role historically served by town squares, markets, or churches. "Identity," Graesch says, "is at the root of all archaeological research, even if it isn't explicitly recognized as such. We aim to understand the behaviors—social, economic, political, religious—that bring together and divide groups of humans." In these social spaces people form shared identities, identities that might be visible in their material culture.

Smoking often goes hand in hand with drinking, but Connecticut, like many states, doesn't allow smoking in bars. So the



Among the sites studied as part of the cigarette project, the deck of the Exchange Cafe, a riverside restaurant and bar, resulted in a deck “toss zone” for cigarette butts. Archaeology students meticulously documented the find spot of each artifact.

habit has become part of an extended social experience as patrons leave their seats and assemble outside. “I began to think more critically about the analytic possibilities of cigarettes,” Graesch says. The cigarettes themselves, including how they were smoked, put out, and disposed of, could be markers of social belonging in the community formed by each watering hole.

Graesch teaches a class on the archaeology of modern life, Urban Ethnoarchaeology, and he mentioned his thoughts on bars and cigarettes to students in search of a project. What began as a pilot study of four bars soon grew to consume the course and the archaeology lab. The cigarette project offered intensive training in field collection, documentation, analysis, and interpretation. But it wouldn’t be easy. “He did not waste any time making sure any romanticized notions of what archaeological practice is were obliterated,” says Sarah Shankel, a student in that first class in 2012 who has just completed a graduate degree in anthropology.

Graesch and his students—soon all were taking part—started collecting cigarette butts, as well as observing the bars and talking to owners and employees to learn more about the

community frequenting each one. Across 30 days of collection at 26 sites (23 of them bars, 19 within a quarter-mile radius), they collected, by gloved hand, more than 42,000 specimens from gutters, sidewalks, decks, under decks, deck “toss zones,” and other spaces. “There’s nothing quite like waking up early on the weekend to go crawl around in front of a bar picking up people’s poorly disposed-of cigarette butts,” says Shankel. “The comedic aspect of it didn’t escape us.”

They did ethnographic work to see where people smoke, to fine-tune collection schedules (to account for, for example, a 1980s glam rock karaoke night and a hip-hop DJ night at the same bar), and to document the behavior of street cleaners, janitors, and the occasional sweeping bar owner. They collected from the same sites multiple times (unlike other archaeological sites, these “repopulate” with artifacts in a short period of time), for a total of more than 700 surface collections. The bag from Los Angeles also made a reappearance, as a non-bar control sample. “We were aiming for a *robust* data set,” Graesch says.

The next challenge was to document, identify, and classify the butts. Graesch and his students needed a comparative collection, the same way an archaeologist excavating a household midden might need a collection of mammal bones against which to compare and classify their finds. Their research turned up some 67 brands produced by 24 manufacturers that comprised some 341 unique types of cigarettes with distinctive sizes, tipping paper, icons, bands, lettering, and more. Using funds from a supportive dean, they bought more than 350 packs, which Graesch calls “the largest collection of cigarettes as well as the most comprehensive cigarette and cigarette package catalogues at an institution of higher education.”

THE ARTIFACTS, IN A WORD, STANK. Combined with the knowledge that each of the butts had spent recent time in someone’s mouth, Graesch says, “you’ve got one of the least charming artifacts, ranking somewhere lower than a discarded nip [liquor] bottle, but well above a soiled disposable diaper.” They ran air purifiers in the lab, became experts in ventilation, and packed sample boxes with newspaper treated with vinegar and baking soda. “I never smelled cigarettes on my clothes and, as far as I’m aware, neither did any of my friends,” says Tim Hartshorn, another student in that first class who went on to serve as a lab assistant and is now coauthoring a journal paper with Graesch. “Then again, who knows? Maybe they all thought I’d taken up smoking.”

The contents of each sample bag were placed in a plastic tray and then the butts were allotted to petri dishes based on type and provenience. “We sorted through our collection bags like we were digging for gold,” says Zoë Leib, a student in the 2013 class. “Really stinky, damp gold.” The students documented the presence of lipstick or gloss, weathering, how much unsmoked paper remained, and the method of extinguishing (the twist, the crush, the twist and crush, and the “I’m so angry I’m going to squish it into a tiny ball”—terms of art, all). Each of these attributes may reflect, together or in isolation, some aspect of the social ritual of smoking and bar-centric community building.

“The students were champs,” says Graesch. “My students see cigarettes in ways that the average passerby does not.” This sort of “professional vision,” like being able to see and document strata at an excavation or spot a potsherd in the dirt, only comes with hands-on experience and repetition. “Within a couple of weeks, students were thinking more critically about the relationship of objects to behavior and beginning to formulate new hypotheses about the content and organization of assemblages in certain spaces,” he adds. The students also began to understand the behaviors and natural



Cigarette butts were stored outside (top) because of their odor. In the lab, Zoë Leib compares artifacts against a reference collection (bottom) to determine the brand and type of each butt. The presence of lipstick, weathering, and method of disposal were documented.

processes, known as site formation, that alter the distribution, frequency, and variety of artifacts. Rain causes butts to accumulate against curbs, but also washes some away. Crabbers—“cigarette foragers”—nick artifacts the way an amateur collector or looter might. And the students have become, like Graesch, hyperaware of cigarette butts on the street. “After you’ve contemplated their analytical value,” Graesch says, “it’s difficult to ‘unsee’ these artifacts.”

THE RESULT WAS A MASSIVE DATA SET. Its size and complexity permitted Graesch and his students to connect the humble artifacts with social cohesion, environmental impact, and the chemical signals that future archaeologists might associate with our time. “I like to think that this project turns ‘normal’ on its head,” Graesch says, “and makes visible a material record that is otherwise, and surprisingly, invisible and unnoticed.”

In the ongoing, preliminary analysis, Graesch and a new batch of students are finding that the types of cigarettes smoked and discarded does indeed “map” onto the types of bars in the study—but only with careful controls that account for when a bar’s regular patrons are present. On a busy Friday night, or a night with some other event that attracts additional patrons, the assemblage of butts in front of a given bar might be far different from when that bar’s core community—the regulars, think *Cheers*—are there. “Looking at the individual butts as data points, each fitting into their own taxonomical species, each carrying an evolutionary story, meaning, indication of the environment,” says Leib, “I can no longer look at a cigarette butt without wonder.”

In the course of the project, Graesch was struck by the variety of different types of cigarettes, including the exotics that found their way from all over the world to the small city. “These little artifacts evince a frequency and type of transience that isn’t otherwise signaled in the built environment and material record,” he says.

Graesch and his students were also intrigued and troubled by the staggering volume they collected in just a few dozen days, and the potential ecological impact. Why, he and his students thought, should this kind of litter in particular be so widely tolerated, even though cigarette butts hold many toxic compounds that can leach out into rivers, lakes, and oceans? “I can think of no other social science better equipped than archaeology to ferret out the complex behaviors accounting for the unregulated and unquestioned discard of hazardous waste on the urban landscape,” he says. “I imagine archaeologists working more closely with environmental scientists, municipalities, and the architects of public policy.”

According to Graesch, the “archaeology of toxicity” they’ve begun to examine is particularly interesting to students—and could also be to archaeologists of the distant future. “The toxic residue of everyday life in the twentieth and twenty-first centuries will likely be the subject of environmental archaeology for decades to come.” ■

Samir S. Patel is deputy editor at *ARCHAEOLOGY*.

LETTER FROM WALES

An aerial photograph of the Penycloddiau hillfort in Wales. The hillfort is a large, irregularly shaped enclosure built on a hillside, with its ramparts visible as a series of parallel lines. The surrounding landscape is a patchwork of green fields and brown, wooded areas. The hillfort is located in the Clwydian Range.

The ramparts of the Penycloddiau hillfort in Wales' Clwydian Range enclose about 60 acres, making it the largest such site in Wales.



Hillforts of the Iron Age

Searching for evidence of cultural changes that swept the prehistoric British Isles

by **ERIC A. POWELL**

In late summer, the heather on the bleak, windswept moorlands of the Clwydian Range blooms deep purple. A series of hills and mountains in northeast Wales, not far from the English border, the Clwydians are today a popular destination for hikers who share trails with flocks of grazing sheep. Those making the arduous scramble to one of the summits are rewarded with views that take in much of Wales and northern England, including the craggy mountains of Snowdonia to the west and the distant peaks of the Lake District to the north. Below the range, the Vale

of Clwyd (pronounced KLOO-id) stretches out like a green and yellow patchwork quilt, the boundaries of farmland marked by tidy lines of trees. This bucolic landscape belies the fact that dramatic events played out here some 2,800 years ago. Around that time, people were transitioning from the Bronze Age to the Iron Age and, under circumstances that are still not entirely clear, built a series of enormous enclosures called hillforts, whose origins and ultimate purposes are, for now, lost to time. Archaeologists are currently excavating at hillforts in the Clwyd-

ian Range to understand both their construction and the conditions that convinced people to come together and pool their labor to erect these monumental feats of prehistoric civil engineering.

Sited on hilltops of varying elevations, and differing widely in size, hillforts feature deep ditches and earthen and stone ramparts that were probably topped by wooden stockades. The sheer size of the sites has drawn the attention of archaeologists since the nineteenth century. Much of what we know about hillforts in the British Isles comes from excava-

tions in southern England where many archaeologists think the majority of the sites were initially built between about 700 and 500 B.C. But Wales rarely figures in discussions about the Early Iron Age. “Wales was always considered the periphery. But the Clwydians have one of the densest concentrations of hillforts in Britain,” says University of Liverpool

at the massive Penycloddiau (pronounced pen-a-KLAW-thee-eye) hillfort. It is the largest such site in Wales, encompassing some 60 acres. By one calculation, 10,400 trees would have been felled during its initial construction.

Another group, led by University of Oxford archaeologist Gary Lock, has been digging for five years at a

is the fact that the people living in northern Wales during the Iron Age mysteriously abandoned the use of pottery, an archaeologist’s favorite means of studying cultural change through time.

What scholars do know about the Early Iron Age in northern Wales and across the rest of Britain is that it was a time of profound cultural



The strategically placed hillfort of Moel-y-Gaer, Bodfari, sits above the confluence of two rivers and, during the Iron Age, would probably have controlled an important pass through the Clwydian Range.

archaeologist Rachel Pope. “When we talk about understanding the Early Iron Age, it makes sense to try to come to grips with what people were doing here during that period.” Pope, in fact, suspects that some hillforts in northern Wales may actually predate those in southern England. She is one of several archaeologists focusing on the Clwydian Range, and her team is currently excavating

nearby site, the five-acre Moel-y-Gaer, Bodfari. Lock notes that the search for evidence in the Clwydian Range is challenging because the same acidic soil that allows blooming shrubs such as heather to thrive also makes preservation of bones and artifacts extremely rare. “You don’t get involved with the Welsh Iron Age if you want clear answers,” says Lock. Compounding the difficulty, he says,

change. During the Late Bronze Age, from about 1000 to 800 B.C., people buried magnificent bronze artifacts in hoards that archaeologists interpret as symbolic burials celebrating the wealth of high-status individuals. This practice had come to a halt by around 800 B.C. “The whole thing suddenly collapses,” says Lock, “and then you get the rise of the hillforts.” These structures, which had to have

Chicago Doctor Invents *Affordable* Hearing Aid Outperforms Many Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, and Throat (ENT) physician, Dr. S. Cherukuri, has just shaken up the hearing aid industry with the invention of a medical-grade, affordable hearing aid. **This revolutionary hearing aid is designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.**

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Dr. Cherukuri knew that untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer’s disease. **He could not understand why the cost of hearing aids was so high when the prices on so many consumer electronics like TVs, DVD players, cell phones, and digital cameras had fallen.**

Since Medicare and most private insurance plans do not cover the costs of hearing aids, which traditionally run between \$2,000-\$6,000 for a pair, many of the doctor’s patients could not afford the expense. Dr. Cherukuri’s goal was to find a reasonable solution that would help with the most common types of hearing loss at an affordable price, not unlike the **“one-size-fits-most” reading glasses** available at drug stores.

He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, almost all of these were found to amplify bass/low frequencies (below 1000 Hz) and were not useful in amplifying the frequencies related to the human voice.

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affordable device like an iPhone® for about \$200 that could do all sorts of things, I could create a hearing aid at a similar price.”

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been built by large numbers of people acting together, were made throughout the British Isles, most predominantly in a wide swath of land extending from northern Wales south to the English Channel. In the past, scholars thought hillforts were a response to increasing violence, and that this zone represented an unstable border region where conflict or political instability was particularly acute. But Lock and others now feel that while they may have had defensive purposes, they signal, more importantly, a shift in the culture's values. "In the Early Iron Age we see a change from people celebrating high-ranking individuals to marking the importance of larger communities," says Lock. "Whether we call them tribes or something else, it's clear that larger groups are coming together in this period and building hillforts. They supplant bronze hoards in the archaeological record, and that can't be a coincidence."

Many hillforts do show signs of being built for defensive purposes, and their locations, with many of

them near passes or river valleys, suggest they were built to dominate strategic points on the landscape. But no two hillforts are alike. Some excavated hillforts have evidence of streets and houses that suggest permanent occupation, while others don't seem to have had sufficient structures for regular, long-term use. These were perhaps employed by wider communities to meet, trade livestock, and participate in ceremonies. Multiple entrances at some hillforts suggest to archaeologists that some were intended for ritual processions.

Another possible explanation for the rise of hillforts is that they were a way for people to cope with climate change. For most of the Bronze Age the climate was milder than it is in Britain now, but some data suggest that it became cooler around 800 B.C. The decline in temperature wasn't gradual, but rather was a sudden shift that would have been noticeable to farmers who could have seen the growing season shorten within a lifetime. "On the western coast of

Britain, the effects of the change might have been felt first," says Pope. "It's possible that people first began to build hillforts here as part of their effort to deal with the climatic shifts." She posits that Iron Age people may have come together in the hillforts during this period and formed super-households of a number of families in order to safeguard livestock and pool resources.

The debate over the uses of hillforts may never end, but each one has its own story to tell. That makes excavation of largely ignored sites, such as those in northern Wales, all the more important in unraveling the mystery of what happened in the British Isles during the beginning of the Iron Age.

Archaeologists have dug at the hillforts atop the Clwydians sporadically since the nineteenth century, and attention to the area's Iron Age landscape was renewed in 2008 when regional

(continued on page 60)



On a summit a few miles south of Penycloddiau, the ramparts, seen encircling the hillfort of Moel Arthur seem to lend it a more obviously defensive character than other sites in the Clwydian Range.

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By gathering atop a number of widely separated hill forts, and by signaling with flashlights, volunteers have been able to determine that the sites would have been visible to one another at night.

(continued from page 58)

archaeologist Fiona Gale helped organize the Heather and Hillforts project. A government-funded effort aimed at cataloguing and protecting the range's rich natural and archaeological resources, the project lasted four years and involved detailed surveys of six hillforts, including Penycloddiau. Archaeologists also conducted limited excavations at damaged sections of some of the hillforts' ramparts and developed plans to control erosion at the sites most at risk. Gale hoped that by collecting basic data on hillforts, she could help set the stage for more intensive future excavations. "The acidic soil is such a challenge to archaeology," she says. "But I felt sure that our project would lay the groundwork for other digs that could help us understand what happened here in the Iron Age."

The project's other important goal was raising the profile of the hillforts among the public. In 2011 archaeologist Erin Lloyd Jones organized a novel event called the Hillfort Glow experiment. Lloyd Jones studies the relationship of hillforts to each other, and wanted to test the "intervisibility" of the sites in the Clwydian Range and in the neighboring Cheshire region. "We wanted to look at the hillforts not in isolation, but in terms of their connections to each other,"

says Lloyd Jones. To that end, she arranged for around 350 volunteers to climb 10 separate hillforts at nightfall,



Archaeologists excavating the ramparts of Moel-y-Gaer, Bodfari, have unearthed stone foundations that appear to have been repaired many times and are more complex than the team expected.

some at a distance of up to 16 miles from each other. At a prearranged time, the volunteers signaled to each other with high-powered "newt torches," flashlights that naturalists use to search for newts at night, as proxies for beacon fires. "It succeeded beyond our wildest expectations," says Lloyd Jones. "We could see hillforts that you have trouble seeing in the daylight. That I didn't expect." She hastens to point out that it is

impossible to know if all the hillforts were occupied at the same time, since radiocarbon dates are difficult to come by in northern Wales, another casualty of the region's acidic soils. But the experiment demonstrated that contemporaneous sites across a wide area would have at least been aware of each other, and may have been knit together across a landscape they shared and strove to dominate. Interestingly, many of the numerous local myths and legends dealing with hillforts involve giants, and may be a reflection of how their sheer size has continued to impress people. "If you think about it, even abandoned hillforts must have played a role in later peoples' lives," says Lloyd Jones. "Just look at how big a presence they are today, more than 2,000 years later."

In 2010, while the Heather and Hillforts project was still under way, Gary Lock was teaching an extension class at the University of Oxford on Iron Age hillforts. An expert in the period who is putting together a comprehensive atlas of hillforts in the British Isles, Lock has delivered many lectures on the topic and, at the end of the class, was ready

(continued on page 62)

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to answer the usual questions he is peppered with by fans of archaeology. But he was unprepared for one question. “A gentleman came up to me and said, ‘How would you like to excavate a hillfort in Wales?’” Lock laughs, still astonished at the memory. “That never happens.” As it turned out, the hillfort of Moel-y-Gaer, Bodfari, had been in the family of the man’s wife, Banba Dawson, for more than 100 years. Her father had been a scientist, and he had long been curious about the hillfort and interested in its protection. Dawson invited Lock and his team to work at the site, which is on a steep hill that rises some 600 feet above the small village of Bodfari, not far from the six sites included in the Heather and Hillforts project. Ringed by two ditches and a pair of formidable ramparts, Moel-y-Gaer, Bodfari, was originally excavated in 1908, but had been left largely undisturbed since.

The site differs from those included in the Heather and Hillforts project in that it sits at a low altitude. Its location, though, must have been irresistible in ancient times. Moel-y-Gaer, Bodfari, sits above the confluence of two rivers and guards an important pass through the range. “It’s a strategic position,” says Lock. “From here



The acidic soil of the Clwydian Range means artifacts are rarely preserved. Nonetheless, two stone spindle whorls have been discovered so far at Moel-y-Gaer, Bodfari.

they could have controlled much of the movement into and through the Vale of Clwyd.” It may be the lowest lying of the hillforts, but when viewed from below, the scale of the ramparts dominates the landscape.

Now in their fifth year at Moel-y-Gaer, Bodfari, Lock and his crew are concentrating on two areas, digging sections of the rampart and ditches to understand the sequence of construction, and unearthing the remains of a large structure within the enclosure known as a roundhouse. The team has so far unearthed the remains of a 10-foot-deep ditch—much bigger than expected—cut into the bedrock. They have also exposed a series of stone foundations for ramparts that show they were repaired or rebuilt multiple times, indicating the

site may have been in use for a long period.

This season, the team discovered charcoal near the base of one of the foundations, which gives them hope that they might get an elusive radiocarbon date in the near future. They have also excavated much of the roundhouse, which was identified through remote sensing, but have thus far discovered only two artifacts, a pair of stone spindle whorls. The objects demonstrate that weaving, a domestic activity, took place on the site. John Pouncett, Lock’s coinvestigator, says that indicates that at least a few people probably lived there. “The spindle whorls also tell us that the people raised sheep and that the hillfort was used to secure livestock,” he says. “These objects take us outside the hillfort and help us understand how it was connected to the surrounding landscape, which is largely agricultural now and likely was then, too.”

The team plans on another five years of excavation of the site’s surprisingly intricate ramparts. “Our work thus far has shown there was a massive investment of time and labor at Bodfari,” says Lock. “Looking at the ramparts you don’t really get a sense of how complex they are, but excavation shows how much work they took to construct.” Iron tools didn’t appear in large numbers in Wales until late in the Iron Age, meaning that the backbreaking work of digging the deep ditches and constructing the ramparts would have been done with



At Penycloddiau, archaeologists are excavating a section of the hillfort’s ramparts adjacent to one of its entrances.



From the ramparts of Moel Arthur, which in July are covered with blooming heather, Penycloddiau, to the north, is clearly visible by day.

bone and antler tools. Given the time and resources that would have been involved in building the hillforts, Lock believes they could only have been constructed by a large alliance of family groups in the surrounding countryside coming together.

One of the most exciting finds of the last season was a single piece of bone, possibly from the skull of a sheep or goat, discovered in the roundhouse. It's a small but telling piece of evidence. "There's no way to know for sure," says Lock, "but it could have been left behind after a ritual feast, when the larger community came together to celebrate an event, and we may be able to radiocarbon date it."

Penycloddiau is no more than four miles from Moel-y-Gaer, Bodfari, but it is much higher, at an elevation of almost 1,500 feet. Even in July, the summit of Penycloddiau is a cold place to be, buffeted by wind and rain that must make the hundreds of students who participate in the excavations here wonder how the Iron Age people ever found the spot appealing. Under the direction of Rachel Pope, this season the students are excavating a rampart at the east entrance to the hillfort, and have

exposed chaotic and dense layers of rocks. As at Moel-y-Gaer, Bodfari, there is evidence that the rampart was repaired or reconstructed, possibly over a long period of time. Not far from the ramparts, another group of students is digging a roundhouse, carefully scraping away minute layers of earth in search of material that could yield radiocarbon dates. The dwelling is one of 70 roundhouses that have been identified on Penycloddiau. Unlike Moel-y-Gaer, Bodfari, the site must have been home to a large population by the standards of the time.

No artifacts have been discovered at the site yet, which doesn't surprise Pope, and not just because the soil in the Clwydians makes preservation difficult. "In the late Bronze Age, you have all this wonderful experimentation in the material culture," says Pope. "Then something happens to change that. The Early Iron Age sees much less of that experimentation. You of course have the hillforts, an effort to make a statement on the landscape, but they are low in material culture. It must have been a harsher time."

Pope's team will excavate at Penycloddiau for two more seasons. Their work so far has helped enable them to understand the construc-

tion sequence of the site's ramparts. Pope's codirector, Rich Mason, has also discovered evidence of a previously unknown entrance due west of the one they are currently excavating, suggesting that Penycloddiau had multiple ritual entrances that were used during celebrations. And while hard evidence for an early date of the hillfort remains elusive, Pope points out that the period was a complicated time that would have been experienced differently by people living in northern Wales. "We need to understand the region on its own terms," says Pope. "After the excavations here and at Bodfari are complete, we'll have a better understanding of the Iron Age in the Clwydians, which has been such a black hole for us."

To appreciate the scale of Penycloddiau, it pays to make the steep hike up Moel Arthur, a hillfort just two miles south. Likely named sometime in the Middle Ages after the legendary British king, the site has a more overtly defensive feel than the other hillforts in the range. On the north and east sides, two imposing, heather-clad ramparts still stand as high as six feet. It's not hard to imagine them patrolled by warriors during times of crisis. At the same time, the vistas would have made a magnificent backdrop to rituals.

From the top of Moel Arthur, Penycloddiau dominates the view to the north. As Pope says, the site seems like a bold statement on the landscape, broadcasting a message that is muted to us today, but one that must have been clear to its Iron Age builders. Whatever the cultural nuances of that message, the once-mighty ramparts of the hillforts still impart a sense that whatever their troubles, Iron Age people once endured and even thrived here. ■

Eric A. Powell is online editor at **ARCHAEOLOGY**.

To see virtual reconstructions of hillforts, go to www.archaeology.org/wales



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featured on the *ARCHAEOLOGY* magazine website in 2000. Since then, 17 digs from around the world have been featured. Interactive Digs continue to be one of the most popular features on the website, with more than 300,000 visitors each year.

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Heritage and Archaeology Project (BCHAP), in the town of Trim, County Meath, Ireland, is conducting community-based research and training excavations of the remains of a thirteenth-century Dominican friary and is bringing to light the friars and townspeople who lived, worked, and were buried there.

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are excavating the only known mountaintop Minoan settlement. Located on a plateau on Mt. Ida, Zominthos lies on the ancient route between the famous palace at Knossos and the sacred Ideon Cave, where many believe the god Zeus was



Exploring the 19th-century deserted village on Slievemore, Achill



Cutting 3, south wall of a cloister under excavation at Blackfriary

archaeologists conduct their research, how inferences are drawn from the uncovered clues, and how the data are used to interpret the past. Follow an Interactive Dig to connect with the archaeologists, comment on and discuss their projects, peruse images and video clips of ongoing excavations, and interpret finds as they are uncovered.

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The Achill Archaeological Field School (AAFS) is located in the village of Dooagh on Achill Island—the largest of the islands off the Irish coast and the most northwesterly point of Ireland. AAFS staff and students are working on developing a detailed understanding of the archaeology and history of Achill Island.

The Blackfriary Community

born and raised.

On Johnson's Island in Ohio, archaeologists are exploring barracks and associated buildings that once housed Confederate POWs. In 2015, the project focused on excavating the prison hospital.

To participate in these Interactive Digs and to read about past projects, please visit www.interactivedigs.com.

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Lecture Program

THE 120TH YEAR OF the Lecture Program is under way, and once again the AIA is sending renowned scholars to its Local Societies to share the latest from the field of archaeology. Two of these scholars are this season's Samuel H. Kress Lecturers: Daniele Federico Maras and Lorenzo Nigro.

Maras received his Ph.D. in archaeology from La Sapienza, University of Rome. His many accomplishments include a position as associate research scholar of the Italian Academy for Advanced Studies in America at Columbia University, and as a Margo Tytus Visiting Scholar at the University of Cincinnati. So far, Maras' most requested lecture topic is "Greek Myths, Etruscan Women: Goddesses and Heroines in Light of Etruscan Society and Religion," but he also speaks on a variety of topics related to his specialties in classical archaeology, Etruscology, classical religion and



Kress Lecturer Daniele Federico Maras



Kress Lecturer Lorenzo Nigro

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mythology, Latin and pre-Roman epigraphy, and ancient art history. Maras will be lecturing in Eugene, Oregon; Phoenix, Arizona; Berkeley, California; Ann Arbor, Michigan; Cincinnati, Ohio; Louisville, Kentucky; Ithaca, New York; Pittsburgh, Pennsylvania; Lawrence, Kansas; Richmond, Virginia; Indianapolis, Indiana; Boston, Massachusetts; and New Orleans, Louisiana.

Nigro is associate professor of Near Eastern archaeology and the coordinator of the Oriental Section of the Department of Sciences of Antiquities at La Sapienza, University of Rome. He has participated in archaeological expeditions in the Near East and the Mediterranean and is presently the director of both the Rome "La Sapienza" Expedition to Motya in western Sicily and the Rome "La Sapienza" Expedition to Palestine and Jordan. His most requested lecture topic thus far is "The Phoenicians at the World's Ends: The Formation of Mediterranean Civilization as Seen from the Island of Motya in Sicily," and he will also speak on other topics related to his wide experiences in Levantine and Mediterranean archaeology. Nigro will be lecturing at AIA Local Societies in Charlottesville,

Virginia; Huntsville, Alabama; Washington, D.C.; Baltimore, Maryland; Hartford, Connecticut; New Haven, Connecticut; Rochester, New York; Tallahassee, Florida; Boca Raton, Florida; Urbana, Illinois; Rockford, Illinois; and Providence, Rhode Island.

To find out more about the lecture program and to see a schedule of lectures, please visit www.archaeological.org/lectures.

AIA-SCS 117th Joint Annual Meeting, January 2016, in San Francisco

THE ARCHAEOLOGICAL Institute of America (AIA) and the Society for Classical Studies (SCS) invite you to their 117th Joint Annual Meeting, January 6–9, 2016, in San Francisco. The Annual Meeting brings together more than 3,000 archaeologists and classicists from around the world and nearly every state in the United States

AIA President Andrew Moore speaks at the Society Breakfast, Annual Meeting 2015



to share the latest developments from the field. The conference is the largest and oldest established meeting of archaeologists and classical scholars in North America. The Annual Meeting has grown tremendously over the past decade, not only in attendance, but also in the scope of papers presented, demographics of attendees, and focus on professional development, cultural heritage management, new technologies, and other topics of critical importance to the field. To find out more about the 2016 AIA-SCS Joint Annual Meeting, visit www.archaeological.org/annualmeeting.

The primary theme for the 2016 conference will be “Generating Research in Heritage Education.” To stay informed of this and other upcoming activities, and to join in the discussion, please join the Archaeology Outreach and Education Google Group by sending a request to mlanglitz@aia.bu.edu. We value your opinions, suggestions, and participation. By organizing this program, the AIA hopes to continue to encourage the development of a network of educators committed to moving archaeological education forward.



Checking out a Roman soldier's shoes at the Cincinnati Archaeology Fair

Educators Conference at the AIA-SCS San Francisco Meeting

THE AIA WILL HOST its second conference for archaeology and heritage educators on January 9, 2016, at the AIA-SCS Annual Meeting in San Francisco. The 2016 conference will build on last year's program, which gathered key archaeology educators from around the country to discuss the future of archaeological education in a series of panel discussions, roundtables, and workshops. Several collaborations and initiatives conceived at the conference have been taking shape over the last year.

Society Outreach Grants

EACH YEAR THE AIA provides grants to AIA Local Societies to support community outreach programs. To date the AIA has given more than \$120,000 in grants to Societies that have used the funds to create and implement informative and engaging programs. Grants are made twice a year, in the spring and the fall.

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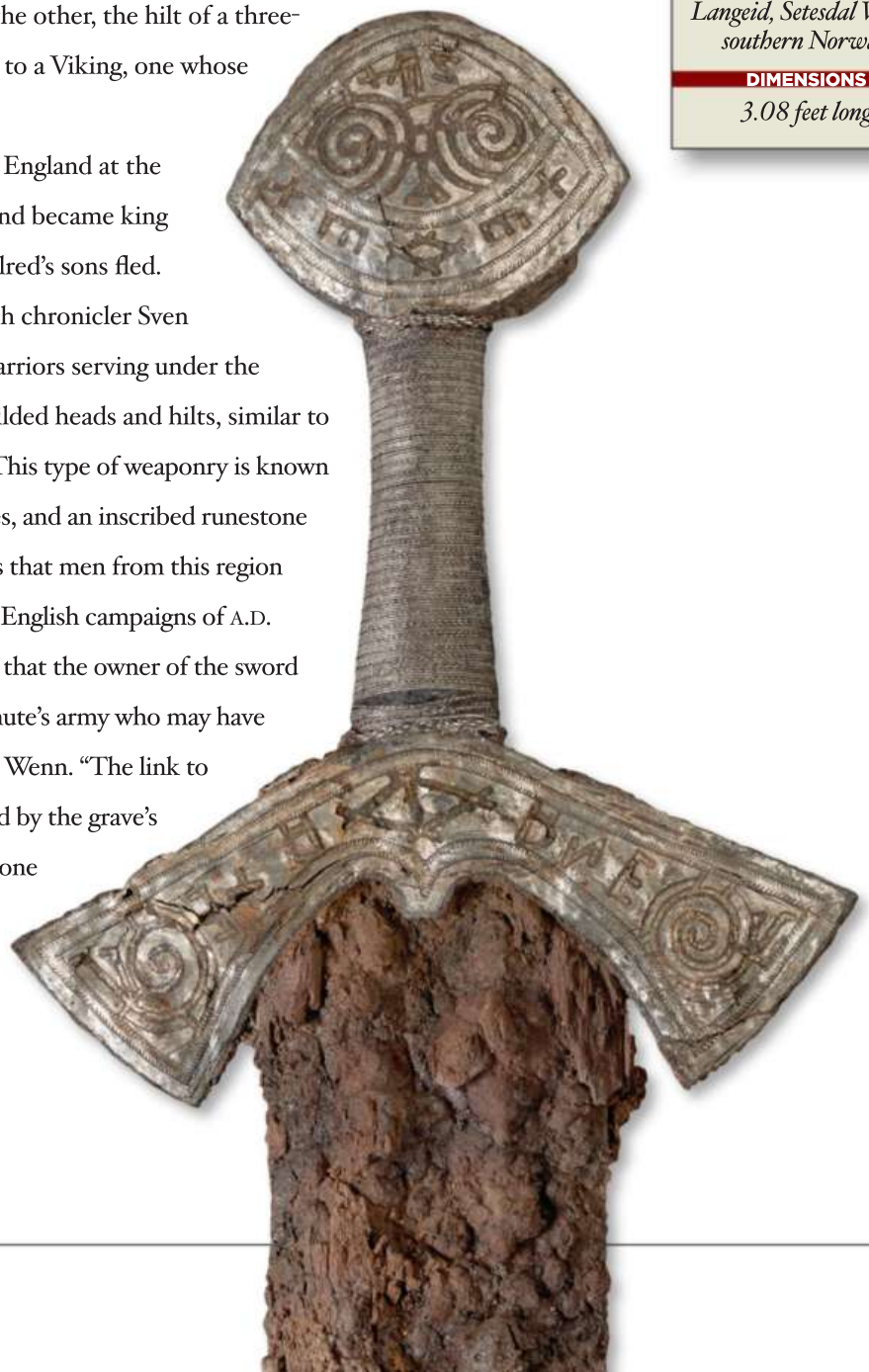
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ARTIFACT

At first the grave's contents seemed poorer than might be expected, given that it was the largest excavated burial in the Langeid cemetery. When archaeologists dug into the coffin, they found just two fragments of silver coins, one from northern Europe, and a penny minted under the Anglo-Saxon king Æthelred II (Æthelred the Unready) in England. Yet the four postholes at the grave's corners made it clear that it had once been roofed, a sign of the deceased's high status. Outside the coffin, however, they soon saw something that, says excavation leader Camilla Cecilie Wenn, "made our eyes really pop" when the dirt began to fall away. On one side of the coffin was a large battle-ax, and on the other, the hilt of a three-foot-long sword that once belonged to a Viking, one whose identity might even be known.

The Viking king Canute invaded England at the beginning of the eleventh century and became king of England in A.D. 1016 when Æthelred's sons fled. According to twelfth-century Danish chronicler Sven Aggesen, the elite force of 3,000 warriors serving under the king carried axes and swords with gilded heads and hilts, similar to the ax and sword found at Langeid. This type of weaponry is known to have been made in the British Isles, and an inscribed runestone found not far from Langeid indicates that men from this region fought with Canute, probably in the English campaigns of A.D. 1013–1014. "We believe it's probable that the owner of the sword and the ax was a warrior in King Canute's army who may have acquired the sword in England," says Wenn. "The link to the British Isles is also well supported by the grave's Anglo-Saxon coin, which is the only one unearthed in the cemetery."



WHAT IS IT

Sword

CULTURE

Viking

DATE

First half of the 11th century A.D.

MATERIAL

Iron, silver, gold, silver thread, copper alloy thread

FOUND

Langeid, Setesdal Valley, southern Norway

DIMENSIONS

3.08 feet long



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